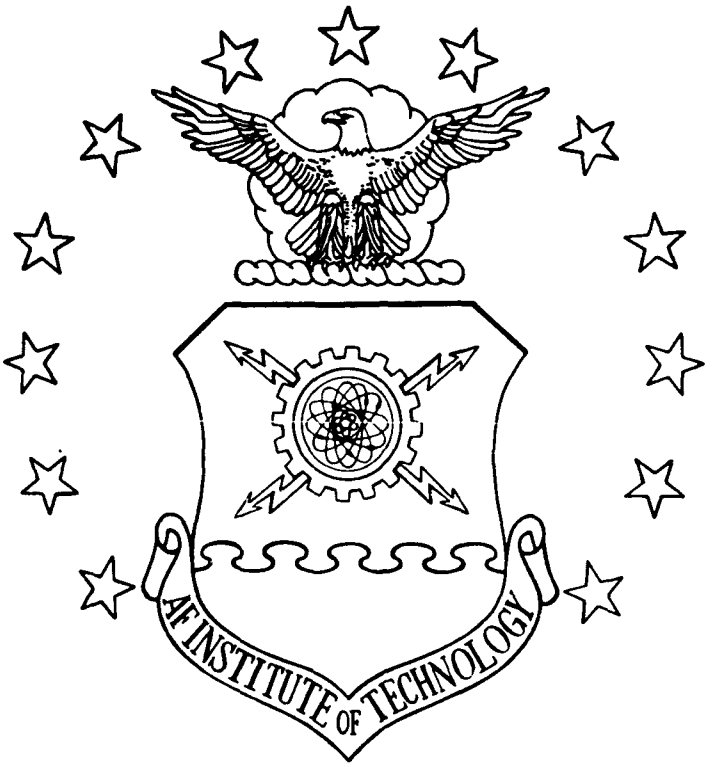

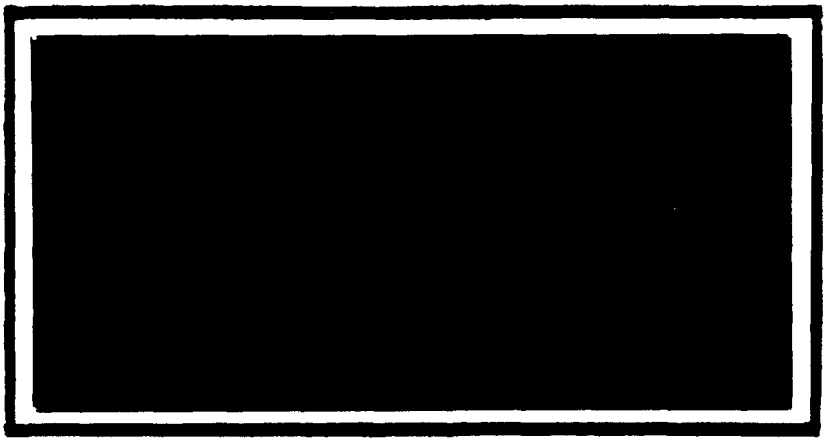

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Wright-Patterson Air Force Base, Ohio

AFIT/GLM/LSM/90S-44

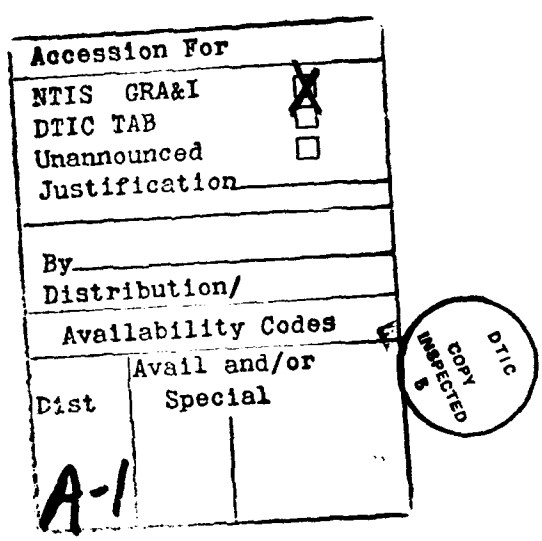
AUTOMATING ESTABLISHMENT MANAGEMENT FOR THE RAAF MOTOR TRANSPORT FLEET: A MICROCOMPUTER DATABASE APPLICATION

THESIS

Robert T. Quirk
Flight Lieutenant, RAAF

AFIT/GLM/LSM/90S-44

The opinions and conclusions in this paper are those of the author and are not intended to represent the official position of the DOD, USAF, or any other government agency.



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THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Robert T. Quirk, B.Bus.

Flight Lieutenant, RAAF

September 1990

Preface

The purpose of this study was to research the requirements for, and develop, a microcomputer based database application to automate establishment management of the Royal Australian Air Force (RAAF) motor transport (MT) fleet at the Directorate of Movement and Transport Air Force (DMOVT-AF). This application was assessed by DMOVT-AF as the priority module for development as part of a larger management information system (MIS) for RAAF MT assets.

This research selected systems analysis tools and the most appropriate software, determined user requirements, developed, evaluated, and validated a prototype system. The resulting software application, the MT Establishment Management Information System (ESTAB), met user requirements, improved efficiency, and accuracy of MT establishment management at DMOVT-AF. ESTAB integrates data from various sources and provides the ability to add, edit, and report MT establishment information.

This research is just the beginning of providing automated information support for the management of RAAF MT assets. Additional research should continue to build on the ESTAB database and application to reap greater efficiency and productivity benefits for the RAAF.

In performing this research and writing this thesis, I had a great deal of help from others. I especially wish to thank a few people. Thanks to my thesis advisor, Major Phil Beard, for giving me direction and encouragement, and introducing me to the advanced programming tools available for database applications. This thesis would not have been possible but for my Australian connection. I wish to thank Squadron Leader Pete Haren for his assistance and patience through this marathon.

Finally, I wish to express my thanks to my wife Kristina and dedicate this thesis to her. I would not have been able to spend the time and effort to produce this work, if not for her constant understanding and support. Thanks KQ!

Robert T. Quirk

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Abstract

The purpose of this study was to research the requirements for, and develop, a microcomputer based database application to automate establishment management of the Royal Australian Air Force (RAAF) motor transport (MT) fleet at the Directorate of Movement and Transport Air Force (DMOVT-AF). This application was assessed as the priority module for development by DMOVT-AF as part of a larger management information system (MIS) for RAAF MT assets.

This research selected systems analysis tools and the most appropriate software, determined user requirements, developed, evaluated and validated a prototype system. The resulting software application, the Motor Transport Establishment Management Information System (ESTAB), met user requirements, improved efficiency, and accuracy at DMOVT-AF. It was designed to operate on IBM compatible personal computers in accordance with Australian Department of Defence DESINE standards. ESTAB integrates data from various sources and provides the ability to add edit, and report motor transport establishment information.

AUTOMATING ESTABLISHMENT MANAGEMENT FOR THE RAAF MOTOR TRANSPORT FLEET: A MICROCOMPUTER DATABASE APPLICATION

I. Introduction

Background

The objective of the Australian Defence Force (ADF) is to

> plan, develop and maintain forces for contingencies within Australia's area of direct military interest, to defend Australia and its interests at sea, on land and in the air, or any combination of these (Commonwealth of Australia, 1988:1).

The Royal Australian Air Force (RAAF) Manual of Motor Transport Operations states that

> for the RAAF to fulfil its commitments within the ADF, the RAAF requires a well balanced fleet of modern general purpose and special purpose vehicles appropriate to its operational and administrative needs (Department of Defence, 1989a:1).

The RAAF allocates specific numbers and types of vehicles considered necessary for efficient daily functions to individual RAAF units.

RAAF Motor Transport Asset Management

Asset management of the RAAF motor transport (MT) fleet is divided between three levels: Directorate of Movements and Transport - Air Force (DMOVT-AF), Support Group 3 (SG3) and Road Movements Sections (RMS).

DMOVT-AF. The highest level of management of the RAAF MT fleet is vested in the DMOVT-AF, Air Force Office. As the fleet controller, DMOVT-AF is responsible for administering the RAAF MT Establishment Tables which reflect authorised allocations of vehicles.

SG3. SG3 of Headquarters RAAF Logistics Command is responsible for daily fleet management activities including allocation of resources against establishment tables, and acquisition and disposal directions for fleet vehicles.

Base RMS. RMS are responsible for managing and allocating vehicles at the Base level. The typical Base RMS is divided functionally into four areas: Aircraft Refueling, Vehicle Despatch, Licencing and Trade Testing, and Administration. The Aircraft Refuelling function is responsible for providing aviation fuel to home based and transit aircraft. The Vehicle Despatch function is responsible for the allocation of vehicles to meet ad hoc and scheduled tasks. The Trade Testing function is responsible for testing and administering Service driving licence requirements for all RAAF and civilian members on that Base. The Administration function is responsible for issuing petrol, oils and lubricants (POL), maintaining vehicle data, ensuring serviceability of all vehicles, and providing administrative support to the Vehicle Despatch function. The Administration function manually manipulates and maintains all Base MT vehicle despatch, vehicle use, and administrative data. Aggregated data for the management of the vehicle fleet is manually transmitted yearly to DMOVT-AF and to SG3. DMOVT-AF maintains MT establishment tables on a microcomputer in word-processing format with a UNIX™ operating system. This information is manually maintained at other levels. SG3 maintains

a database of vehicle data under AlphaBasic™ on a Alphamicro™ computer. This system is expected to be enhanced for use on an NCR Unix™ based local area network. DMOVT-AF reviews Base vehicle allocations on an ad hoc basis using sample data provided from manual Base RMS records. This information, coupled with user mission requirements, is used to verify vehicle establishments.

DESINE. The Defence Electronic Data Processing (EDP) Systems Integrated Network Environment (DESINE) project will provide the Department of Defence with a standard information systems architecture for the next five years (Commonwealth of Australia, 1988:67). Under this project a greater number of microcomputers will be available throughout the RAAF. This provides a unique opportunity to implement microcomputer based management support systems. Before the adoption of the DESINE standard, the ADF postponed many small computer projects to reduce future computer hardware incompatibility problems.

Despite the increasing availability of computer hardware there is no comprehensive management information system (MIS) that links the common data requirements for DMOVT-AF, SG3, and Base RMSs. The RAAF maintains data for the RAAF surface vehicle fleet on a variety of manual and computerised information systems with data gathered from several organisations and publications. Current techniques are inefficient and cumbersome. Commercially available and government developed software systems are unsuitable for RAAF MT management needs. The RAAF requires a tailor-made MT MIS to improve MT management efficiency at DMOVT-AF (Department of Defence, 1988:xi).

DMOVT-AF's current word-processing and SG3's current systems are implemented on microcomputer systems that fail to conform with DESINE

standards and will be unable to communicate with future systems.

As the establishment tables drive other elements of the asset management system, automation of this area will have the highest priority in development of an MIS (Haren, 1989; Miller, 1989).

Specific Problem

The problem is to define the requirements for, develop, and evaluate a prototype microcomputer database application which will improve efficiency in data processing and management of the RAAF MT fleet establishment at DMOVT-AF.

Research Questions

To enable development of an application to improve the efficiency of RAAF MT establishment management the following questions must be answered:

1. Is a database application suitable for improving the efficiency of RAAF MT asset management?

2. Which are the most appropriate systems analysis and software techniques for developing a database application?

3. What are the data processing and information requirements for executive level RAAF MT asset management?

4. Which data processes and information requirements can be improved by using a microcomputer database application?

5. Can appropriate computer programs be generated to meet those user requirements assessed as being most appropriate for automation?

6. How can the application be validated to ensure successful implementation and acceptance by users?

7. Does the proposed system provide improvements in efficiency when compared with current management practices?

Scope of the Thesis

A management information system can be described as a computer-based information processing system designed to support operations, management, and decision support functions of an organisation (McClave and Benson, 1988: 955). This thesis will result in a microcomputer database application for use at DMOVT-AF with an accompanying user's manual. This thesis will not deal with specific programming techniques except where explanation is necessary to ensure adequate documentation for future program modifications and additions.

Limitations

Time limits the scope of this thesis. An ideal MIS for the management of RAAF MT assets would incorporate information requirements from all levels of management within the Service and may even incorporate requirements for ADF-wide management of surface vehicle assets. This thesis will only address the problems associated with information management at the executive level of the RAAF, namely DMOVT-AF.

Assumptions

The following assumptions apply for the purposes of this study: future RAAF microcomputer systems are International Business Machine (IBM) compatible in accordance with implementation of the DESINE Project; the responsibilities and methods for determining vehicle establishments will not change dramatically in the future; and the basic

MT management structure will also remain stable.

Organisation of the Thesis

This thesis is divided into five chapters and five appendices. Chapter I introduces and details the background of the problem, including RAAF MT management structure and data requirements, a specific problem statement, research questions, scope and limitations of the thesis plus any assumptions made to produce the thesis.

Chapter II contains a literature review that attempts to answer research questions one and two. It can be divided into three main areas: prior ADF and United States Air Force (USAF) studies, information systems analysis and design, and databases and database management systems.

Chapter III describes the investigation of the problem, and uses the chosen systems analysis and design methodologies to produce the application.

Chapter IV compares the application against the user requirements and answers research questions 3 through 7 posed in Chapter I.

Chapter V provides a summary of the thesis, recommendations, conclusions, and a list of suggested follow-on studies.

Appendices provide the application documentation. Appendix A contains the target document. Appendix B is the data dictionary used throughout the thesis and incorporated within the application. Appendix C is the entity attribute list of the database for the application. Appendix D is the ESTAB application User Manual. Appendix E is the total MT MIS entity relationship diagram. Two 5.25 inch computer disks contain the source code of the programs that make up the

ESTAB application. Another 5.25 inch disk contains the installation program which includes the executable ESTAB application and associated databases.

II. Literature Review

Chapter Overview

The purpose of this chapter is to answer research questions one and two from chapter I. The first half of the chapter will provide the reader with an overview of previous studies undertaken by the ADF and the USAF. This is followed by a discussion of databases, database management, systems analysis and specification methodologies, and software suitable for the task.

Research Question One

Is a database application suitable for improving the efficiency of RAAF MT asset management?

A review of previous studies undertaken by the ADF and the USAF into methods for improving the management of MT assets suggests a database application would be suitable for improving the efficiency of RAAF MT assets.

Prior ADF Studies

BSMART. Recognition of the need for computer-based assistance for management of supply related activities resulted in a project called the "Base Supply Management and Running Transport" (BSMART) system which commenced in 1985. The project's concept centered on capturing relevant statistical data at the lowest management level and aggregating it for higher levels of management. The Directorate of Supply Computing - Air Force (DSC-AF) developed two prototypes of the system and a working model of the unit level for Air Force use. One of the secondary functions of the project was to provide a transport fleet management

package at each unit to assist in scheduling vehicle usage and maintenance (Department of Defence, 1988b).

Unfortunately, the goals of the BSMART system were never fully realised due to financial constraints. The non-transport aspects of the system implemented at RAAF Stores Depots have now fallen into disuse (Haren, 1989). The MT aspects of BSMART would have relieved some of the repetition from RMS management activities while allowing greater management visibility of many functions including the use of all MT assets.

Defence Commercial Vehicle Review. Concern over increasing costs associated with managing and maintaining private vehicle fleets within the ADF, and the reduction in funds allocated for this purpose, led to investigation of new management practices at all management levels. In 1988, the Department of Defence appointed Pak-Poy and Kneebone with Henderson Consultants to undertake a three phase investigation designed to improve the cost effectiveness of the Defence Commercial Line (CL) vehicle fleet. The subsequent report stressed the requirement for greater amounts of accurate and timely vehicle data for decisions concerning all aspects of operations (Pak-Poy and others, 1988:75). Highlighted for special attention was optimising vehicle resale values at disposal. Specifically, the consultants' report recognised the need for a fleet MIS to enhance the management effectiveness and efficiency in this area. The report evaluated commercially available and government developed software systems for the task, but found them better suited to private companies as they did not fully meet Defence needs. A tailor-made MIS would need developing either in-house or by a civilian contractor (Pak-Poy et al, 1988:x-xi). The operation of a

fleet MIS requires uniformity across all users. The report recommended introducing an ADF-wide system to be managed by the Royal Australian Navy (RAN) for the other two Services. Subsequent discussion within the Department of Defence and between the RAN, Australian Army, and RAAF led to the specification of some tri-Service requirements for an MT MIS. The discussion produced a decision that management of all aspects of the Services' fleets would remain with the individual Services. Requests for tender for the supply of computer support for acquisition and disposal of RAAF CL vehicles are being prepared. This process will take some time to complete and will only account for a small element of the total fleet MIS requirements for the RAAF (Haren,1989).

USAF Vehicle Asset Management Systems

Obvious similarities exist between the RAAF and USAF concerning fleet management practices. Both systems are organised on approximately the same basis with vehicles allocated against authorised establishments based on mission requirements and use. A support group is tasked in both organisations to fulfill the establishments and forecast future purchasing requirements. Experiences within the USAF regarding the development of computer based support for the management of vehicles should therefore be of some use historically.

The USAF has enjoyed the use of microcomputers for some years. Such an environment has led to the development of several specific-to-type asset management systems. Some of these systems deal directly with elements that would be appropriate to RAAF MIS applications while others show the advantages of asset management systems in the military.

War Reserve Material Vehicles. First Lieutenant Robert S. Thomas, in his 1988 AFIT Thesis, A Computer Based Data Management System for Air Force War Reserve Material (WRM) Vehicle Management, addressed the lack of computer support for the tasks associated with the management of the 12,000 WRM fleet vehicles positioned throughout Europe. In circumstances similar to the RAAF MT asset management problem, a series of reports highlighted the need for more accurate and timely information on the disposition of MT assets. Attempts were made to provide additional support to management, but delays in development of systems prompted Thomas to develop a microcomputer based system for transport personnel managing WRM assets. The WRM Vehicle Management System uses database software to provide a capability for vehicle dispersal/distribution management, release case management, scheduled action management, and a variety of reports for all or subsets of the fleet (Thomas, 1988).

Vehicle Master Plan. Another AFIT Thesis produced by First Lieutenant Hans Garcia in 1989, titled A Computer Based Data Management System for Automating the Air Force Vehicle Master Plan, developed a microcomputer database management application to automate the labor-intensive tasks performed by vehicle program managers at Warner-Robins Air Logistics Center. This organisation's tasks are very similar to those performed by SG3 in the RAAF. The programs produced by Garcia can be used to provide a single source of information on the vehicle fleet allowing development, justification, and ranking of vehicle programs to meet USAF vehicle needs (Garcia, 1989).

Computer Assisted Transportation System (CATS). The Air Force Logistics Management Center (AFLMC) developed CATS as a microcomputer

based system consisting of several independent modules designed to "improve readiness and increase productivity and efficiency" at base-level vehicle operations (Department of the Air Force, 1988:182).

One module, the Vehicle Asset Management System (VAMS), is a complete package for managing vehicles at the Base level. Apart from assisting with administrative tasks, VAMS automatically reconciles the On-Line Vehicle Interactive Management System (OLVIMS) information with vehicle authorisation and assignment data.

Another module is a driver evaluation system developed by Captain James Van Scotter in 1986. While outside the scope of this thesis, the Computer Assisted Transportation System Driver Evaluation System provides important insights into possible applications that could be included in a complete MT MIS. This set of application programs was also developed for use on microcomputers using a database language. It is aimed at helping Base management increase productivity by assisting with the management of vehicle operator qualifications, vehicle trainer qualifications, lesson plans, accidents, abuse cases, and misuse cases. It generates licenses and provides tools for analysis of the previously detailed areas (Van Scotter, 1986: 1).

Another system to assist with vehicle management is the Priority Buy (PRIBUY) system. The USAF Standard Systems Center (SSC) developed PRIBUY to assist major USAF commands develop annual priority purchase submissions. This system is also microcomputer based.

SSC is also developing the OLVIMS system to improve handling procedures and management of the vehicle maintenance activity. The first of three stages of this system is complete and allows interactive data entry and edit capabilities on a mainframe computer. The next

stage will make a transition to microcomputers from the mainframe while stage three plans to provide the capability to automate work orders (Department of the Air Force, 1988:182).

Vehicle Operations Automation. In June 1988, additional automation requirements for Base-level transportation management were identified by AFLMC in another report by Van Scotter titled Vehicle Operations Automation Requirements Document (Van Scotter, 1987b). The report outlines the functional requirements for computer systems in three base-level vehicle operations activities: driver evaluation, vehicle asset management, and fleet utilisation and cost reporting. In compiling the report, AFLMC studied previous projects to determine the limitation of existing software in these areas. The document provides a checklist for elements to be considered in any military fleet MIS, but only those elements dealing with asset management will be considered in this thesis.

Other Military Database Management Systems. Many other microcomputer database applications have been developed for specific uses within the USAF. The ability to develop and introduce these systems quickly has resulted in solutions that otherwise may have taken many years to achieve via normal Service systems development cycles. The common availability of microcomputers within the USAF work environment has provided a fertile environment for the development of these applications. The future availability of microcomputers throughout the RAAF will provide the catalyst for the production of many similar prototypes and functional applications. The arrival of the RAAF Base Squadron Administrative Computer System (BSACS) at Base level and the introduction of microcomputers at higher command

levels heralded a new era in computer support for management in the RAAF in 1988. However, the proliferation of the hardware highlighted the need for developed applications to make full use of each microcomputer system's potential. The investigator witnessed that with many users untrained in programming skills, systems did not provide expected benefits. Applications were developed piecemeal at various locations and implemented without precise systems analysis or design. Poorly developed software and database design can produce maintenance problems that could plague the organisation for many years. Any failure to provide applications for current and future RAAF microcomputer assets means that existing inefficiencies will continue. Expected productivity increases over manual practices also will not be realised.

Databases and Database Management

"Database technology facilitates the production of information. The fundamental purpose of all information systems is to reduce uncertainty" (Kroenke and Dolan, 1988:25). The reduction in computer hardware costs and increasing labor costs make the adoption of computer systems attractive for many organisations. Database processing transfers the workload from people within an organisation and places it upon the hardware while substantially increasing the productivity of users (Kroenke and Dolan, 1988:9, xvii). Database technology was developed, to a great degree, to overcome the limitations associated with file processing systems. A database application, therefore, provides many advantages over traditional file management techniques (Kroenke and Dolan, 1988:9).

Databases. A database may be defined as a collection of interrelated data stored together (Martin, 1977:23). Databases provide the following functions which allow maintenance and manipulation of data more efficiently, effectively, and safely than prior to their development:

a. data can be entered and stored efficiently with little or no harmful redundancy,

b. data can be protected with error-checking and consistency-checking functions,

c. data can be protected from unauthorised access,

d. the impact of software errors can be reduced,

e. data can be maintained independent of applications that use the data, and

f. current data can be maintained in a central location for use by many applications (Martin, 1977:22-23: Banet et al, 1985:5).

The structure of a database consists of characters, fields, records, and files. Raw data, represented as characters, are grouped into a field or fields to form a single piece of information, such as a vehicle registration number. Several fields or attributes are grouped as a record to represent information about an entity or an object. A file is a collection of records (Martin, 1977: 48-52; Wray, 1988:7).

A database is also called a "self-describing collection of integrated records" (Kroenke and Dolan, 1988:11). This data self-description is achieved through the data dictionary and a description of the relationships between the data elements in the records. The data dictionary provides a description of the structure of the database and makes program independence with database processing possible (Kroenke

and Dolan, 1988:11). Program independence allows development of many applications for the same database without the programmer needing to consider the physical storage format of the data (Martin, 1977:28). The data dictionary, as an important documentary tool, will be discussed in greater detail later in this chapter. The relationship descriptions are stored and recalled during the processing of the database (Kroenke and Dolan, 1988:13).

Database Types. Based on representation of data relationships, there are three types of databases: hierarchical, network, and relational. "The combination of microcomputers and the relational model present some tremendous opportunities in end-user database processing" (Kroenke and Dolan, 1988:23). Relational databases are the most common type in use today. One of the main advantages relational databases have over other types of data organisation is that relational data models, at least conceptually, store data in a manner that users can understand (Kroenke and Dolan, 1988:21).

Relational databases use two-dimensional tables to represent data and relationships (Martin, 1977:202-203). These tables or rectangular arrays can be described mathematically as relations with the following properties:

> 1. Each entry in a table represents one data item; there are no repeating groups.
> 2. They are column-homogeneous; that is, in any column all items are of the same kind.
> 3. Each column is assigned a distinct name.
> 4. All rows are distinct; duplicate rows are not allowed.
> 5. Both the rows and the columns can be viewed in any sequence at any time without affecting either the information content or the semantics of any function using the table (Martin, 1977:203).

Database Management System. The database management system (DBMS) consists of programs that process data within the database. It allows

data to be integrated and interrelated, reduces data duplication, ensures data integrity, eliminates program dependency on file formats, and allows complicated entities to be represented and retrieved (Kroenke and Dolan, 1988:9). A relational DBMS achieves these tasks by adhering to the properties associated with that type of relationship and data representation. Database processing programs call the DBMS to access stored data. This contrasts with traditional file processing programs, which access stored data. This feature allows the application programmer to be much less concerned with the physical storage characteristics of the data (Kroenke and Dolan, 1988:9-10). This accords with what Martin states as "the ultimate objective of data-base systems": to make application development easier, cheaper, faster, and more flexible (Martin, 1977:34).

DBMS Applications. Applications are programs that provide users with access to the DBMS. Due to the user-friendly products developed by DBMS vendors, simple applications may be developed by users with little or no programming expertise (Kroenke and Dolan, 1988:342). More complex applications, such as the subject of this thesis, may exceed the level of user expertise and make user development impossible. They require another party to develop and maintain the application for the user.

Characteristics of a Good Relational DBMS Application. Applications should make maximum use of the benefits associated with relational data representation by meeting several characteristics. These characteristics can be divided into essential and desirable. Usable applications must be able to perform the following essentials:

1. print queries and update objects or representations of things from the users' environment,

2. allow users to direct and control processing of the application, and
3. always maintain security and integrity of the database.

The ideal characteristics of a DBMS center on the application being the user-database interface. The application should be: easy for authorised users to make authorised requests with valid and accurate data, provide informative and helpful error messages to authorised users who make mistakes or unauthorised queries, and prevent unauthorised users from accessing the database. Unfortunately, these characteristics are not always realised due to limitations in time and budget, knowledge or abilities of developers, and other constraints (Kroenke and Dolan, 1988:256).

Research Question Two

Which are the most appropriate systems analysis and software techniques for developing a database application?

Information Systems Analysis, Design, and Administration

Preliminary Investigation. Ignoring proper development practices and standards has lead to a growing trend of poorly structured database programs that cannot be maintained and must be scrapped (Liskin, 1988a:79). While microcomputer databases are small when compared with mainframe computer databases, the development process and the need for administration are the same (Kroenke and Dolan, 1988:341). An accepted definition of systems analysis states that it involves the "examination, identification, and evaluation of components and interrelationships involved in systems" (Weinberg, 1980:6; Colter, 1984:52).

There are many analysis tools and techniques available to system developers to assist the systems analysis process for computer

applications. Selection of a method is necessary to ensure adequate documentation of answers to the research questions and specifications for subsequent software and database development.

Selection of an Analysis Method. Though many techniques are available, none completely support the analysis process. A comparative examination by Colter of available techniques recommends the adoption of a package of system representations as no single tool, technique, or methodology can support the complete analysis of today's complex systems. Organisations should adopt a package that contains a minimum set of system documentation with additional documentation appended where necessary. A common and recommended package consists of data flow diagrams (DFDs), functional descriptions, a hierarchy chart, and the data dictionary. While this form of representation fails to clarify input/output detail or mechanisms, it is otherwise complete (Colter, 1984:64). This deficiency can be compensated for by prototypes to document user requirements for input screens, output displays, and reports. The preference of the investigator and the facilities available in the DBMS product must be taken into account when determining the particular development method to be employed (Kroenke and Dolan, 1988:80). The investigator recognised that those tools identified by Colter are part of a standard package used by the Australian Department of Defence for at least the past 12 years. Communicating system requirements in a standard compact method should therefore be relatively easy to accomplish.

Structured Analysis Tools. The tools identified by Colter have been developed under the discipline of structured analysis which lends itself to implementation through structured programming

techniques. Both techniques use a top-down approach to break larger processes into smaller modules. Structured analysis reduces the size of specification documentation and increases the level of communication between analyst and user through graphics rather than lengthy narratives (De Marco, 1978:10).

Data Flow Diagrams. DFDs portray a system from the point of view of the data and do not show the control path required for processing. DFDs consist of layered representations of individual functions and the flow of data between those functions (Colter, 1984:62). As depicted in Figure 1, four notational symbols are used in DFDs:

a. the data flow (or vector), which portrays a data path;

b. the process (or bubble), which portrays a transformation of data;

c. the straight line that portrays a file or a database;

d. the source or sink, represented by a box, which portrays a net originator or receiver of data normally outside the scope of the study (De Marco, 1978:40).

Functional Descriptions. Functional descriptions clarify the transformations performed on data in the bubble processes of a DFD. Used at the lowest level, functional descriptions take the form of either structured English or pseudocode to specify the logic involved in the process (De Marco, 1978:304-307).

Structure Charts. As DFDs do not document the control between processes, another mechanism, the hierarchy or structure chart is required. These charts represent all the modules in the application and illustrate the hierarchy of control that exists between each module (Fitzgerald, 1980; Colter, 1984:63).

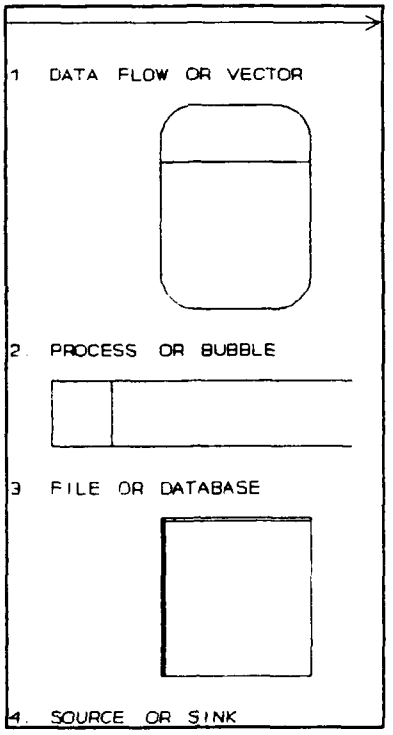

Figure 1. Notational Symbols used in Data Flow Diagrams

Data Dictionary. The data dictionary is a tool that defines the data structure of the system and aids the analyst in simplifying the structures necessary to meet the data requirements of the system (Colter, 1984: 62-63).

It can be subdivided into descriptions of the data elements and descriptions of the relationship between the data elements that form the basis of a database organisation or schema. Common use of the term data dictionary applies only to the definitions of data elements. The description of the data elements should include three definition aspects for each element of the system: the domain of the property, which states all the possible values for the data element; a physical description of the data element, which states the type of characters allowed in the

data, length, and any other restrictions; and a semantic description which states the function or purpose of the data element and will distinguish this property from others that may have the same physical description (Kroenke and Dolan,1988: 90-109).

The relationships between the data elements are best illustrated through using boxes to represent entities or records and lines as relationships between entities. These diagrams are commonly referred to as entity-relationship (ER) diagrams or logical data structures. Figure 2 illustrates the notation used in ER diagrams. The specific relationships between data elements within and between entities are represented using entity-attribute (EA) lists limited to terms defined under the data dictionary. Together ER diagrams and EA lists are referred to as a data model.

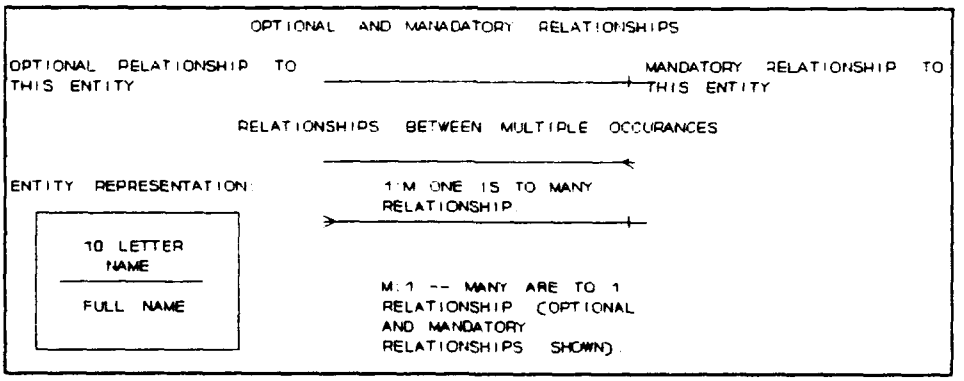

Figure 2. Notation used in Entity Relationship Diagrams

Normalization. Normalization is the process of "elimination and consolidation of redundant data elements in a database (Nantucket Corporation, 1987: Glossary v)". An unnormalised database can contain unnecessary occurrences of information located in different records. This can lead to difficulties in ensuring the accuracy of all

occurrences of that data during additions, modifications and deletions. These difficulties are collectively referred to as modification anomalies (Kroenke and Dolan, 1988:133-134). Normalization aims to identify and eliminate modification anomalies within the data model to achieve all the benefits of relational database structures (Kroenke and Dolan, 1988:133-134).

Six different levels of normalization theory were identified between 1970 and 1981. Not until R. Fagan defined the domain/key normal form (DK/NF) could data be shown to be free from all modification anomalies regardless of their type following the normalization process (Kroenke and Dolan, 1988:137-156). "From a practitioner's viewpoint the most important normal form is DK/NF" (Kroenke and Dolan, 1988:137-8). DK/NF is the primary design goal when constructing record definitions (Kroenke and Dolan, 1988:149).

Fortunately, relational design can also be approached synthetically using the relationships among data elements and can be used to construct a logical database design that is in DK/NF (Kroenke and Dolan, 1988:163). All relationships can be expressed as binary relationships between entities in either one-to-one (1:1), one-to-many (1:M) or many-to-many (M:M) format. The latter of these is represented as two 1:M relationships (Martin, 1977:66-80). Additionally, all relationships are either optional or mandatory in nature (Kroenke and Dolan, 1988:168-183). Only necessary occurrences of data are retained in the databases to represent these relationships.

Database Administration

Database administration for microcomputers is easier than for larger systems because databases tend to be smaller providing less to administer. Unfortunately, this task is often undertaken by those without the skills normally found within an organisation's MIS department. The user must undertake many functions such as file backups, as there is no professional database administrator (DBA) available in the typical microcomputer database environment (Kroenke and Dolan, 1988:344-345).

Some of the DBA's responsibilities include: management of the database activity, managing the database structure, management of the DBMS software, control of concurrent processing, database backup and recovery, database security, and development of new database applications including all the associated documentation (Kroenke and Dolan, 1988:223). Many of these tasks are better suited to experienced MIS professionals and DSC-AF will act as the DBA following development of the prototype (Haren, 1989).

Prototype Development

Prototypes reduce the risks and costs associated with system failures. They are normally developed for the more critical and difficult functions of a larger system (Senn, 1984:20-21). A strategy proposed by Barcomb for the introduction of office automation relies on "prototype, pilot, production" (Barcomb, 1989). This thesis will develop prototype modules of a larger MT MIS for user evaluation as a pilot study. This will reduce the risk associated with development of a large information system.

Structured Analysis Life Cycle

There are many articles and books that discuss the design and evaluation of information systems. Each divide the process into several steps that must be completed in order to analyse, design, develop, and maintain applications successfully. These stages of a systems development cycle are not discrete. Tasks contained within each stage may be repeated many times throughout the life cycle of an application and one stage does not need to be totally complete before another is commenced.

The development of an MIS involves three broad stages: definition of the system, physical design of the system, and implementation of the system (Davis and Olsen, 1985). Successful implementation of a MIS is directly related to the quality of the development process (Alter and Ginzberg, 1978:23-31). While the particular method used to develop a computer application depends on the size and complexity of the project, development of a database system requires similar development steps as any business computer system (Kroenke and Dolan, 1988:75). Many small and large organisations are adopting the Structured Analysis Life Cycle as a standard tool for developing computer systems (Yourden, 1989:78). This life cycle encompasses all development steps encountered in the literature. Nine phases proposed by Yourden for system development under the Structured Analysis Life Cycle are: survey, analysis, design, implementation, acceptance test generation, quality assurance, procedure description, database conversion, and installation (Yourden, 1989:88-94). Figure 3 illustrates these phases and the relationship between them.

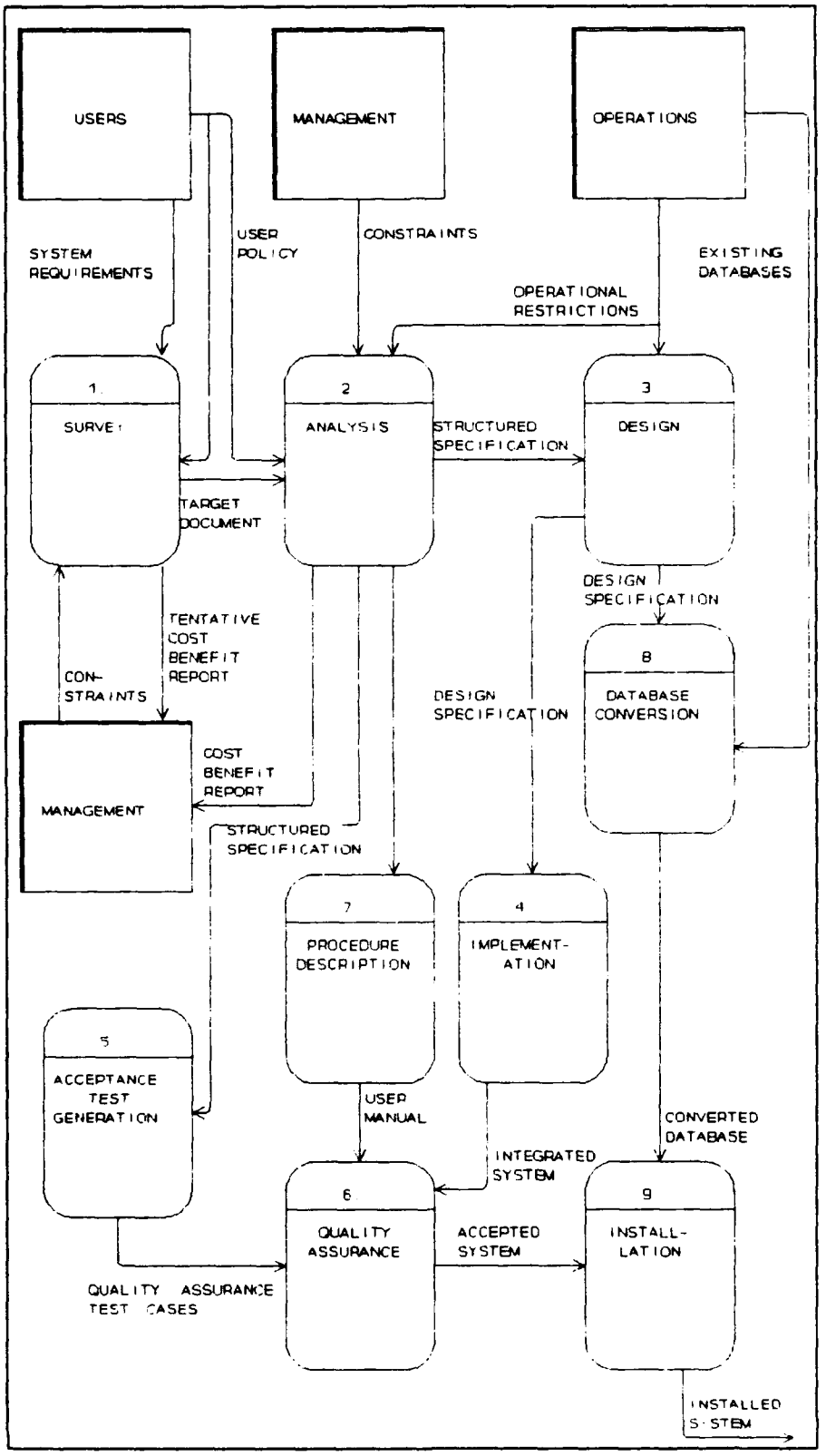

Figure 3. Structured Analysis Life Cycle

Phase 1: Survey. The survey phase defines what the project is attempting to achieve. This stage identifies personnel involved in the project, user perceptions of data, and deficiencies in the users' current environment. An initial scope is developed to limit the size of the project to certain functions and certain users. Two major tools are used in this process: the Initial Context DFD and the Event List.

The Initial Context DFD represents a high level view of the following:

a. The people, organisations, or systems with which the system will communicate. These are called terminators.

b. The data the system will receive from the outside world that must be processed in some way.

c. The data produced by the system and sent to the outside world.

d. The data stores that are shared between the system and the terminators.

e. The boundary between the system and the outside world.

The event list is a narrative list of all the events that occur outside the system to which the system must respond. The events consist of two types. Flow-oriented events, labeled F, occur when a piece of data has arrived from outside the system. These events will relate to a dataflow on the context DFD, but not all dataflows are related to flow-oriented events. Temporal events are triggered by the arrival of a point in time and are not triggered by a flow-oriented event.

Goals and objectives of the new system are also agreed upon with users. The feasibility of using automation to solve the problem must be considered, taking into account cost, technical, and schedule issues (Kroenke and Dolan, 1988:78). Most importantly, a project charter or

target document must be prepared incorporating all the above details. This document describes the details of the project life cycle that will follow and will be used to guide the remainder of the project.

Phase 2: Systems Analysis. The primary purpose of the systems analysis phase is to transfer user requirements and the target document into a structured specification. This transformation involves modeling the users' environment using structured analysis tools such as DFDs and data models. This structured specification defines what the system must do to meet the user requirements of the system.

Phase 3: Design. Portions of the structured specification are allocated to appropriate processors, either man or machine. The design phase incorporates the development of a blueprint for the database and the applications. Data models are transformed into database designs. Application blueprints are designed and represented in structure charts and pseudocode. Reports and menus should be formatted. All design documents should be subjected to a thorough review by users before the next stage. This represents the last opportunity to find errors before building the applications. The costs of mistakes at this point are low compared to mistakes made during the implementation phase.

Phase 4: Implementation. During the implementation phase, the actual database is constructed and the application programs are coded using structured programming techniques and a top-down approach.

Phase 5: Acceptance Test Generation. An acceptance test should be conducted with both new and old systems running in parallel to validate that the system does what it is designed to do. The test criteria must be derived from the target document in the requirement phase and agreed with the users. Test cases are often derived in conjunction with users.

This test closes the loop between requirement and implementation phases.

Phase 6: Quality Assurance. The quality assurance phase is the acceptance test performed by users or some independent body. Minor corrections are acceptable at this stage but the acceptance test does not form part of a debugging process. The results of the acceptance test are binary: either the project was a success and met its targets or it did not. (De Marco, 1978:325-326).

Phase 7: Procedure Description. The Structured Analysis Life Cycle considers the entire system environment and not just the automated portion. User manuals are produced to describe how the users will interact with the system.

Phase 8: Database Conversion. In this phase, all current databases relevant to the system are converted to the new database format, or the information is transferred.

Phase 9: Installation. As the final activity, the accepted applications, converted database, and user manuals are installed into the user organisation. A period of parallel running of new and old systems may follow to allow system introduction to users (De Marco, 1978:325-326: Yourdon, 1989:88-94).

Software Selection

There are a large number of DBMS software packages available for use in developing database applications on microcomputers. The most popular languages for accessing the database are part of a DBMS package and often use an interpreter to convert source code into machine code. These are called DBMS-specific programming languages as they pertain to only one DBMS and include the popular dBASE™ series by Ashton-Tate

(Kroenke and Dolan, 1988:73). "dBASE™ is considered the standard against which all other dBASE™ software should be judged" (Liskin, 1988:103). A number of dBASE™ clones developed over recent years have included the use of compilers. A comparison of their features shows they have begun to outstrip even the latest dBASE™ version -- dBASE IV™ -- with regard to building application programs (Schartz, 1989:89-106). dBASE IV™ has been described as adopting the middle ground between supporting novice and professional programmers (Liskin, 1988:104-112).

Database Compilers. A database compiler is a programming routine that enables a computer to convert a program expressed in pseudocode language into machine language or another pseudocode language for later translation (Stratley, 1988:49).

The use of compilers provides certain advantages over interpreter-based languages especially in the areas of speed, security of source code, and cost. A compiled application will run significantly faster than an interpreted application because the code is already in machine understandable format and does not need further conversion. This converted code cannot easily be tampered with by curious users and provides a great deal of security for program source code as well as protecting the manner in which the database is manipulated. This means that the responsibility for application development and maintenance remains with the organisation having access to the source code. This ensures consistency and control of application programs especially when used by several users. Cost savings accrue from the need to purchase only one copy of the licenced DBMS software for use at the development and maintenance site. With interpreter-based applications a copy of the interpreter software would be required at each user site to enable use

of the applications. At a cost of between US$200 and US$800 for each licenced copy of the DBMS software, this becomes an important aspect in a multiple user MIS environment.

Clipper™. Nantucket Corporation's Summer '87 edition Clipper™ software is described as the "best dBASE™ compiler on the market" as it allows the building of professional applications with useful user-friendly context-sensitive elements (Nantucket Corporation, 1987; Schartz, 1989:104). Additionally, as a development tool, Clipper™ is the high-speed equivalent of dBASE III™ for use by professional programmers (Monk and Landis, 1988:56).

Despite a relatively low profile in the computer industry compared with Ashton-Tate's products, Clipper™ holds 5% of the microcomputer database market (Mace, 1989a:20). It has been successfully used to develop some commercial database applications in such large and noteworthy organisations as Sotheby's Holdings Incorporated (Stoll, 1989:48-49).

Application Development Period. Timesaving application development tools are available for use with Clipper™. Concentric Data System's Relational Report Writer™ version 3 and Relational Report Writer Code Generator™ version 1 will enable professional reports in Clipper™ application programs (Concentric Data Systems, 1988; Concentric Data Systems, 1989). UI Developer's Release version 2™ will assist in production of Clipper™ code for many common database routines as well as user display and menu interfaces (Wallsoft Systems Inc.,1989)

Compatibility. The Clipper™ compiler will also support slightly modified dBASE II™ and dBASE III™ code (Schartz, 1989:99). This compatibility will allow utilisation of previously developed dBASE™

source code in this application and future programs in the MT MIS.

Future Software Developments. Additional developments forecast for the Clipper™ version 5.0 due for release in 1990, will allow true object-oriented-programming (OOP) and interfaces to other than dBASE™ type databases such as IBM's Structured Query Language™ (SQL) (Johnston, 1989:5; Mace, 1989b:20). OOP is an important breakthrough in programming development and can be used in the design of relational databases (Blaha et al, 1988:414-427). SQL™ has developed as a standard in the database processing industry and is implemented in various database products such as ORACLE™ and DB2™ (Oracle Corporation, 1989; Kroenke and Dolan, 1988:321). Both of these products are currently used in the Australian Department of Defence and, as IBM products, should remain in use following the implementation of DESINE. Due to the current performance characteristics and forecast features, the investigator selected Clipper™ as the DBMS for application development in this thesis. The software should insure its availability and compatibility for the life of the application.

Summary

This chapter documented the literature review undertaken to provided answers to the first two research questions from Chapter I.

Research Question One.

Is a database suitable for improving the efficiency of RAAF MT asset management?

An overview of previous related studies undertaken in the ADF and the USAF illustrated the similarities in problem issues and identified possible solutions. The Defence Commercial Vehicle Review saw the need

for development of an MT fleet MIS to improve MT asset management effectiveness and efficiency. A microcomputer information system using database programming emerged as a common solution from other ADF and USAF MT asset management studies.

Of possible database organisations, relational databases offer the greatest potential for use with microcomputers. Many DBMSs are available and make application development easier, cheaper, faster, and more flexible than traditional file processing systems. Maintenance of applications is the responsibility of the DBA. DSC-AF will fulfill that role for any applications developed in this thesis (Haren, 1989).

Research Question Two.

Which are the most appropriate systems analysis and software techniques for developing a database application?

Important issues supporting the selection of a structured systems analysis methodology and a documentation package were detailed. Though many systems analysis techniques are available, none completely support the analysis process. A package approach using a number of techniques appeared as the most appropriate tool for documenting development of a database application.

The proper development of underlying database structures were found to be important for successful applications. A formal application development methodology for use in conjunction with structured systems analysis was introduced. The Structured Analysis Life Cycle emphasizes development of the database structure prior to development of the applications and provides structure for use of the package of development tools. The methodology is accepted as a valid and reliable industry standard for use in developing computer systems.

Software techniques to implement relational databases on microcomputers were examined. Database compilers offer additional advantages over other DBMS software packages for application development. Clipper™ is assessed as the best database compiler commercially available and can be used with timesaving development tools. Clipper™ was chosen as the software for implementation of the application.

III. Methodology

Chapter Overview

The accomplishment of the research objectives followed a series of steps based on the Structured Project Life Cycle. Some of the steps were more applicable than others to this project, so there was more emphasis in those areas. These steps paralleled research questions three through seven detailed in Chapter 1. Table 1 is a timetable of the research methodology process and shows the relationship between the methodology and the research questions.

Phase 1: Survey

This phase defined the problem to be solved by the application, and identified users of the application, as the three members in the MOVT2 area of DMOVT-AF. Approval was sought and granted by the Director of Movements and Transport - Air Force for the project (Miller, 1989). He appointed the senior officer in the MT management area (MOVT2) as the liaison officer and approved the use of interviews with that person (Miller, 1989).

What is the Project Trying to Achieve? A review of current regulations and management requirements assisted in determining some initial data processing needs and information requirements for DMOVT-AF establishment management. Elements from the literature review provided a common frame of reference for definitions and concepts used in this and subsequent phases. The investigator requested sample reports from DMOVT-AF to assist in initial definition of the problem scope. Semi-structured questions, an initial context DFD, and an event

Table 1

Research Timetable

Research Question	Phase	Inclusive Dates
3.	1. Survey	Nov 89 - Jan 90
3.	2. Systems Analysis	Dec 89 - Mar 90
4.	3. Design	Mar 90 - Apr 90
5.	4. Implementation Phase	May 90 - Jun 90
6.	5. Acceptance Testing Generation	May 90 - Jun 90
7.	6. Quality Assurance	Jun 90 - Jul 90
	7. Procedure Description	Jul 90 - Aug 90
	8. Database Conversion	Feb 90 - Mar 90
	9. Installation	Jun 90 - Aug 90

list were developed as tools for describing the system scope. The project can be summarised as trying to:

a. present a more flexible and useable MT establishment database by replacing the current rudimentary data processing system, and

b. automate data record keeping functions for DMOVT-AF with respect to establishment tables and associated information.

What Deficiencies Exist in the Current System? The major deficiency of the current system is the manner of accessing information about the RAAF MT establishment. The system is inflexible, manpower intensive, and overly time consuming (Miller, 1989). Due to the volume of the data involved, the system is also prone to error. It requires

the use of personnel to compile and maintain the data on unrelated manual files and in word-processed format on a microcomputer. Retrieval of historical data poses problems. Information storage is unstructured and information cannot be readily extracted or updated. Lack of access to this information deprives all MT management levels of information necessary for vehicle use control. Vehicles are often employed for purposes for which they were not intended. Staff turnover at all management levels, coupled with the poor data accessibility, exacerbates this problem. With the exception of the unit establishment tables, the current system is unable to produce useful management reports.

What is the Initial Scope of the Project? The initial scope of the project was documented in a Initial Context DFD and Event List. The Initial Context DFD represented the information requirements of the proposed system as they relate to the organisational elements defined in Chapter II The Event List was a narrative list of all the events that occur outside the system to which the system must respond. MOVT2 was asked to examine the Initial Context DFD and Event List for accuracy. During the interview, attempts were made to correct any deficiencies in the diagram and list. A revised Target Document was submitted to the interviewee and was accepted. Appendix A is the agreed Target Document.

Due to the different sizes of establishment tables and their varying levels of complexity, time taken to perform tasks before implementation was difficult to estimate. However, MOVT2 and MOVT2A recorded some estimates for later comparisons in the acceptance testing phase.

Feasibility to Automate? DMOVT-AF currently operates a NCR PC 810 Model MCH4175 computer with an MSDOS operating system, 640 kilobytes of

random access memory, EGA monitor, 360 kilobyte 5.25 inch disk drive and 30 megabyte hard disk (Haren, 1990). The investigator estimated data storage requirements using rough drafts of record size and number of occurrences of each record plus allowance for indexes and programs. Storage requirements of the current system appeared adequate for development of an application. Automating DMOVT-AF establishment management was evaluated as feasible on this microcomputer using Clipper™ software.

Phase 2: Systems Analysis

This phase applied the selected systems analysis tools to express user requirements as models of processes, data relationships, and data definitions. A data dictionary was developed. Further interviews were required to verify requirements and data definitions.

Phase 3: Design

Structured systems analysis techniques, in conjunction with user requirements, determined the processes for automation, and those which should not cross the man-machine boundary. Those areas not considered feasible for implementation on an automated system were highlighted and accepted by the user. Time constraints forced a further reduction in the scope of the project. Establishment Variation Request (EVR) processing, originally earmarked for automation, was eliminated from the scope of the project. This area was of a lesser priority than others identified by the user and would have required interfaces with a system at the RMS level to avoid duplicate data entry. Data models for these areas were retained to illustrate the relationship of data in this system to the remainder of the MT management environment. The user

agreed that these areas would need to be developed at some later stage. This is discussed in greater detail in the next chapter. The target document was amended accordingly.

Alternative computer architecture was not considered due to the implementation of the DESINE project. All hardware and other infrastructure was already in place for implementation of applications within the scope of this thesis. No additional costs were encountered above those already considered.

Phase 3 developed blueprints of the database and application programs. As all functions of the new system revolved around management of an establishment database, emphasis was place on correct identification of data requirements and development of DFDs was limited to generic add, edit, and delete functions. Psuedocode was also developed for these functions.

A data dictionary was developed on dBASE III Plus ™ and produced with Relational Report Writer™. This documented the process of extracting data formats, size, type, authority and source from current reports and Defence Instructions. The data dictionary appears at Appendix B. Data in the dictionary was normalised to third normal form to reduce redundancy and enhance the use of relational database structures. EA lists produced from the database using Relational Report Writer™ appear at Appendix C. These were matched to diagrams illustrating the relationships between data. The ER diagram appears at Figure 9. Data models, including the EA lists and ER diagrams were despatched with the data dictionary to DMOVT-AF. Follow-up semi-structured telephone interviews confirmed the accuracy of the plans prior to the next stage.

Phase 4: Implementation

Phase 4 transformed those areas identified as better suited to automation into Clipper™ programs using structured programming's top-down approach. Figures 4 through 8 illustrate the structure chart developed to provide the investigator with a skeleton framework of modules that required development. UI2™ provided a relatively quick means of developing user friendly pull-down and light-bar menus in the Clipper™ language for the main menu, add, edit, and lookup routines. Relational Report Writer™ and its code generator were used to develop Clipper™ reports from actual and test databases. UI2™ and Relational Report Writer™ code generators use structured programing techniques that aided modular development. User defined functions and other common routines were extracted from these programs to reduce the overall size of the application. Code from these programs was extensively modified to integrate all elements of the application and provide checks of data input to ensure validity. Delete programs were developed to make use of common lookup procedures. All programs were developed with common formats and controls to reduce the need for user adaptation. All programs were compiled with Clipper™ and linked with Plink 86 Plus™ to form a stand-alone executable program (Phoenix Technologies Ltd, 1986).

The applications modules were matched to the event list developed in the Survey Phase. The database constructed from the logical data representations developed in Phase 3 was loaded with sample data as part of the testing of add program modules. Programs were extensively tested for validity and reliability by the investigator. Observations of AFIT volunteers' reactions were used to assess user interfaces with the application (Fogg, 1990; Noble, 1990).

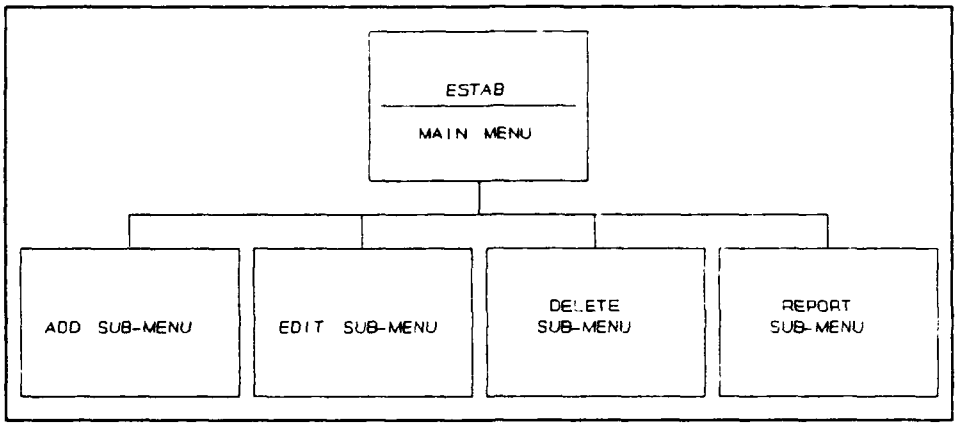

Figure 4. Structure Chart -- Main Menu Modules

Three versions of the application were sent to DMOVT-AF for field testing and evaluation. The first version contained user interface modules to add, edit, and delete data from the databases. The second version added report functions, but had to be sent as two separate applications due to computer memory constraints. These constraints were overcome and the final version combined all programs into one application and included additional help features.

Phase 5: Acceptance Test Generation

Cases, based on user requirements stated in the target document, were developed to test the functionality of the application before it was forwarded to Australia. These mainly centered around providing the abilities to add, edit, delete, and report data found in current reports used by DMOVT-AF.

Phase 6: Quality Assurance

Phase 6 evaluated the new application. Selected AFIT personnel with computer expertise performed a technical review of the application (Beard,1990; Fogg, 1990; Noble, 1990). Once the investigator was

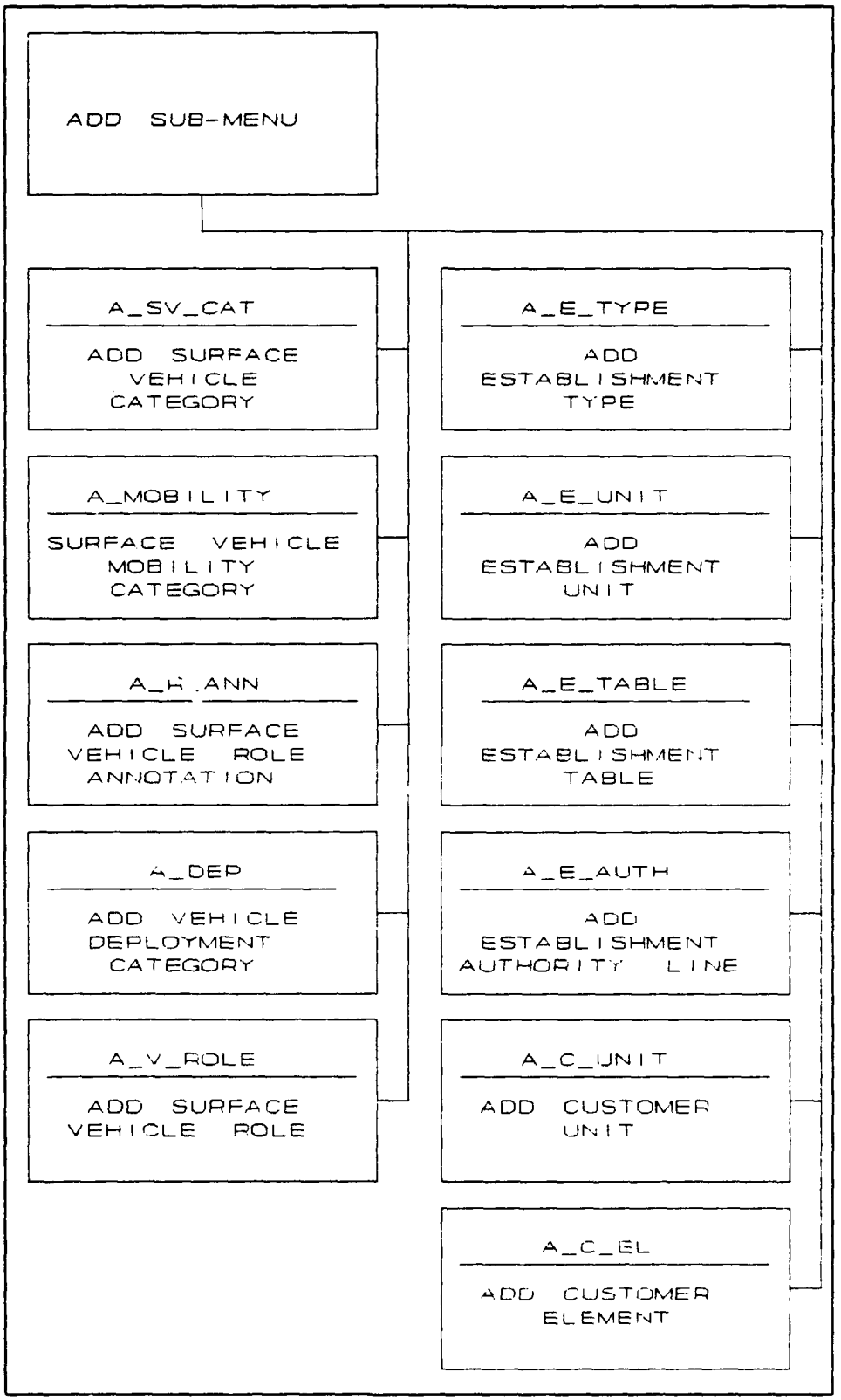

Figure 5. Structure Chart -- Add Modules

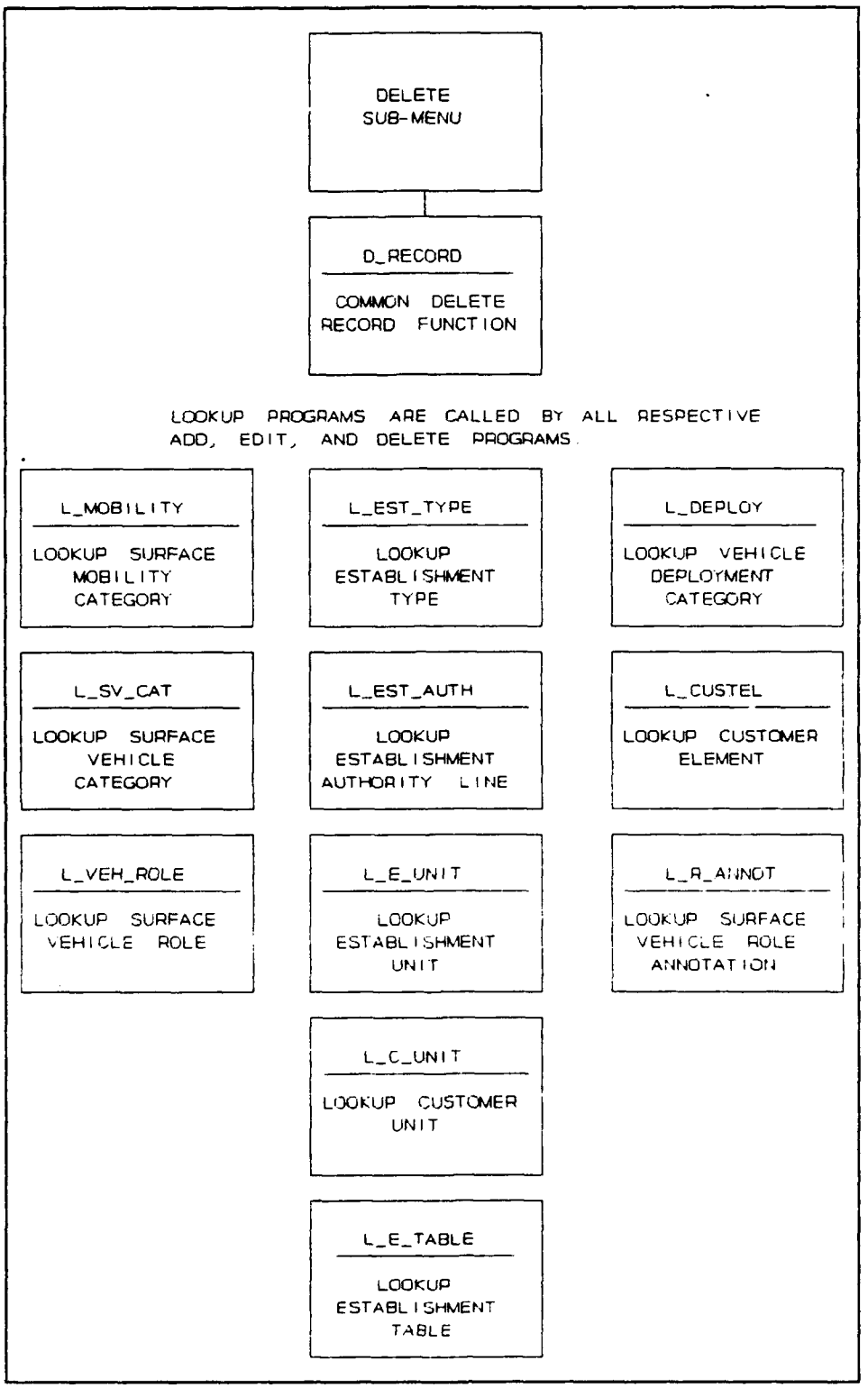

Figure 6. Structure Chart -- Delete and Lookup Modules

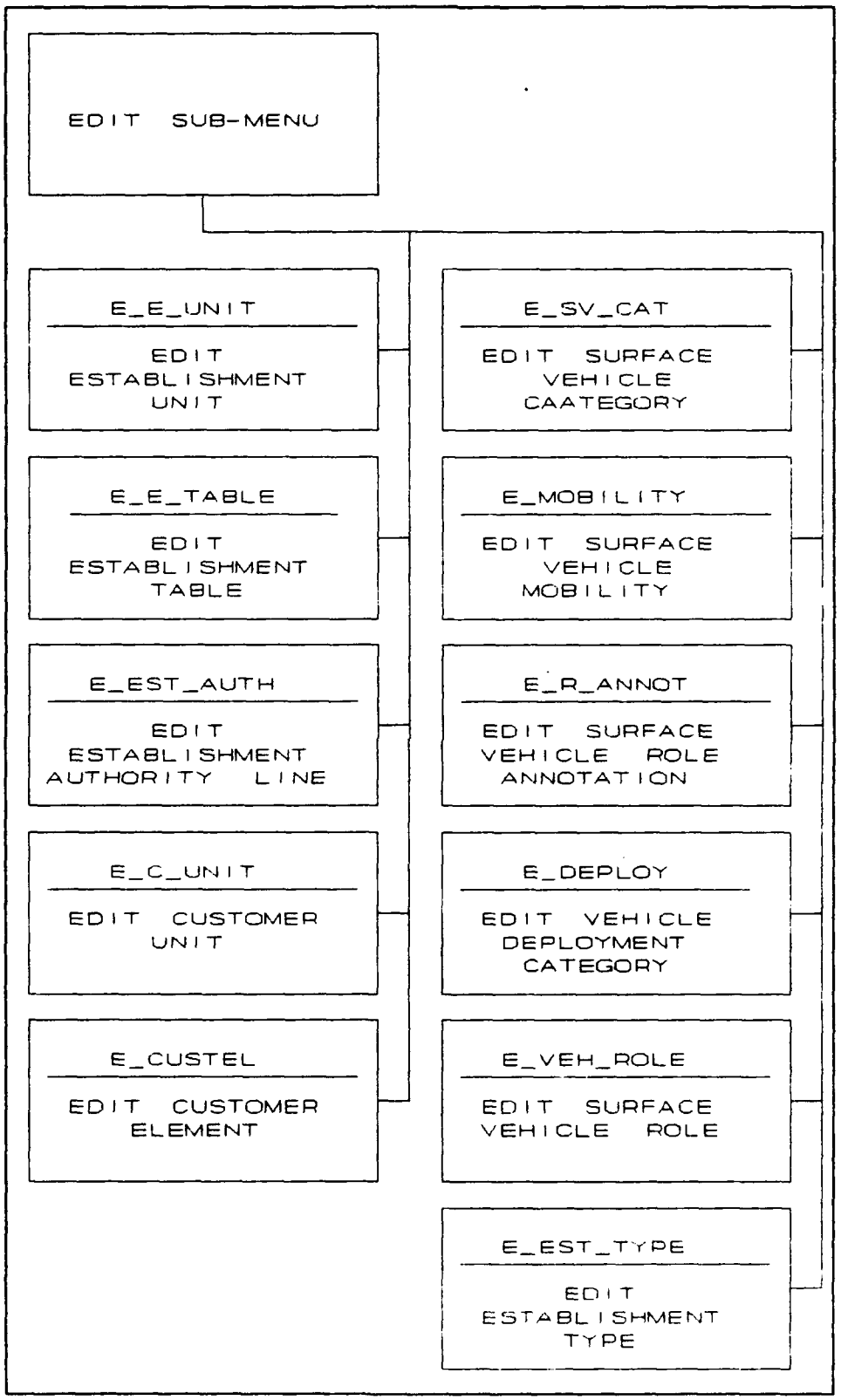

Figure 7. Structure Chart -- Edit Modules

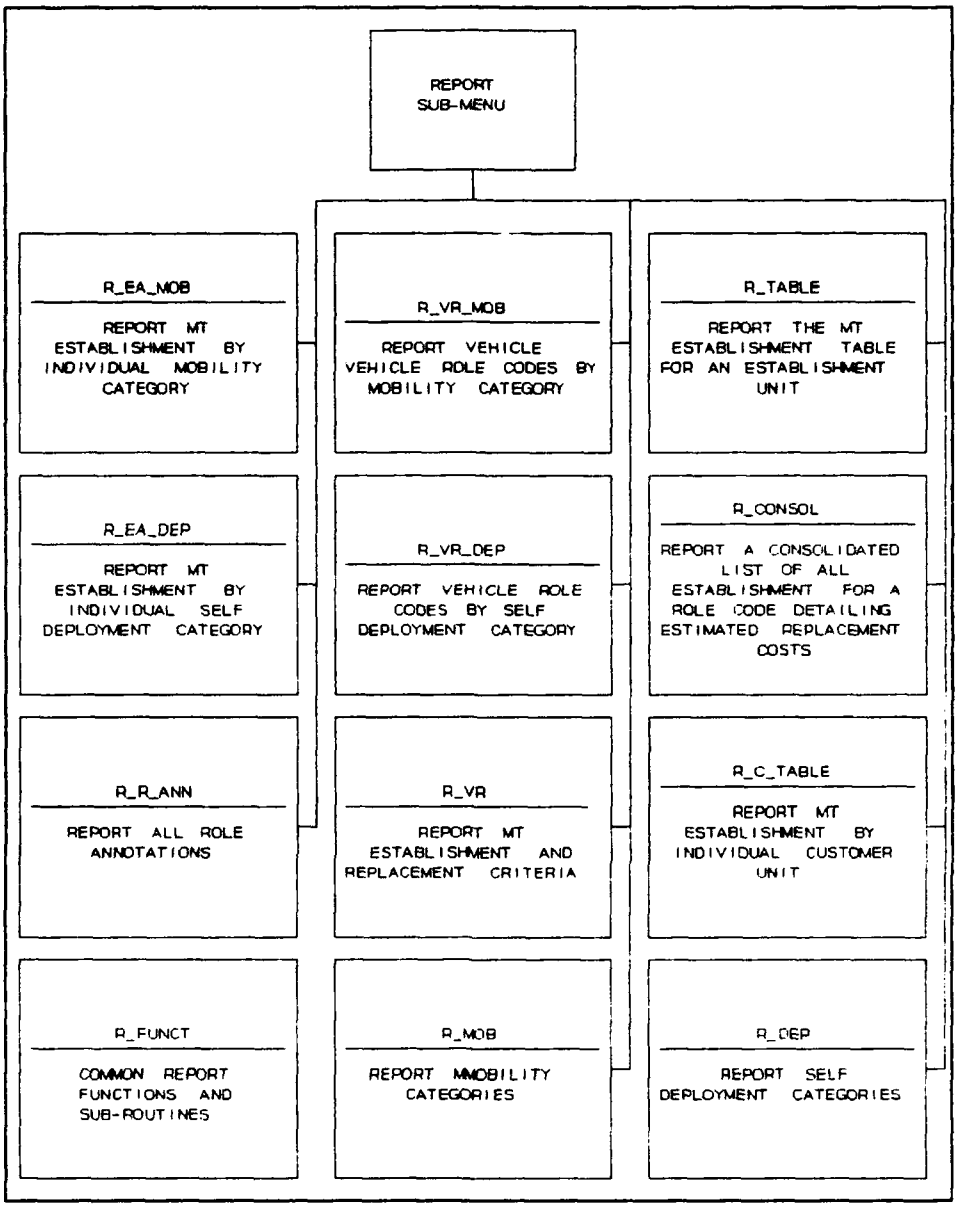

Figure 8. Structure Chart -- Report Modules

satisfied that all the requirements of the target document were met, the system was implemented at DMOVT-AF for parallel acceptance testing. DMOVT-AF staff assessed the usefulness and acceptance of the system using De Marco's acceptance testing criteria (De Marco, 1978:325). They quantified any improvements in efficiency as a result of implementing

the application. These are discussed in the Chapter 4. Additional telephone interviews were conducted with MOVT2 (Haren, 1990).

Phase 7: Procedure Description

A user manual, including a tutorial, was written explaining basic concepts and start procedures for the application. Screen displays were captured using Pizzaz Plus™ software and imported into WordPerfect™ word processing software to illustrate the manual with examples from the application (Application Techniques, 1988; WordPerfect Corp, 1989). Context-sensitive error messages and on-screen instructions developed as part of the application negated the need for a large manual. Appendix D is the User Manual.

Phase 8: Database Conversion

The word-processed information located at DMOVT-AF could not be converted to the new database format. DMOVT-AF supplied current establishment tables for four RMSs (Haren, 1990). Data from two tables was loaded as sample data into the new format with the remainder to be loaded after installation. Vehicle information held at SG3 also could not be converted to the new database due to differences in data formats. Specifications and reports were provided by SG3 (Taylor, 1990). Important data from these was loaded by the investigator to facilitate testing.

Phase 9: Installation

The user manual, accepted application programs, and partially converted database were implemented at DMOVT-AF on 19 July 90.

Summary

This chapter detailed the series of steps based on the Structured Project Life Cycle. This methodology was used to accomplish the research objectives and resulted in the development of a prototype application program. Chapter IV will detail the findings of the research as they relate to the research questions from Chapter I.

IV. Findings and Discussion

Chapter Overview

Chapter I of this thesis developed seven research questions to determine if a microcomputer database application could improve the efficiency of RAAF MT establishment management. The first two questions were answered by the research undertaken in the literature review documented in chapter II. This chapter details the findings of the thesis as they relate to the other questions and related issues.

Research Questions

Research Question Three.

What are the data processing and information requirements for executive level RAAF MT asset management?

"While published data are a valuable resource, seldom is more than a fraction of the existing knowledge in a field put into writing" (Emery, 1985:63).

While the literature review provided a valuable insight into the policy and procedures surrounding the management of the RAAF's MT fleet, not all aspects had been documented. This was especially true of those procedures that were internal to DMOVT-AF.

In an attempt to overcome the disjointed MT information system development described in Chapters 1 and 2, the investigator attempted to account for as many views of MT data as possible. This led to the production of a large ER diagram illustrating the relationships between information in all three major levels of MT management. The scope of developing such an integrated MIS was not possible within the thesis

time line, but the incorporation of the data relationships in an establishment management subsystem would enable later integration. Haventree Software Limited's Easyflow™ was used to produce and maintain the ER diagrams and DFDs (Haventree, 1989). Appendix E illustrates relationships to be considered in an MT MIS.

The relationships and information that form this application can be seen as only a small element of what would comprise a larger integrated MIS. The establishment management information gathered reflects DMOVT-AF's concentration on higher level policy and establishment issues. For that reason, individual vehicle and other transaction specific information was considered outside the scope of this system and more correctly was the domain of the vehicle manager, SG3, and RMSs.

The investigator sought information from DMOVT-AF personnel experienced in MT establishment management's insights on the following:

a. definition of variables and procedures,

b. relationships between variables,

c. undocumented procedures,

d. if the information could be organised in a different manner that would be better suited to automation,

e. unusual cases that would test the system,

f. what is being done to improve efficiency of data processing at DMOVT-AF, and

g. priorities for development.

Relationships and procedures were documented in the data dictionary created in dBase III Plus™. Capturing the purpose of each

attribute along with the source of the data and the requirement for its inclusion proved invaluable for later reference.

Although data definitions were agreed with the user prior to commencement of coding the application, approximately five percent of the definitions required adjustment. These adjustments facilitated data capture and normally dealt with the attribute's size.

The databases provide a means of organising the information in such a way that it will be easy to access and maintain. Rather than requiring access to many different Defence Instructions, information was normalized into 14 databases. Figure 9 depicts a graphical representation of the relationships between these entities.

Customer Element (CUSTEL.DBF). This entity contains information about an element of a unit that requires MT support and has been allocated an establishment authority. This entity would normally refer to a RAAF organisational element known as a section; for example "Aircraft Refueling Section".

Customer Unit (CUSTUNIT.DBF). Information pertaining to the parent unit of customers that requires MT support would normally equate to a RAAF squadron.

Deployment Category (DEPLOY.DBF). This entity contains information about restrictions regarding the deployment of vehicles.

Establishment Authority (ESTAUTH.DBF). Authorised MT establishments previously represented on a word processor are contained in this entity. Each record represents a line on an establishment table.

Establishment Type (EST_TYPE.DBF). This entity details the different classifications of establishments to which an establishment

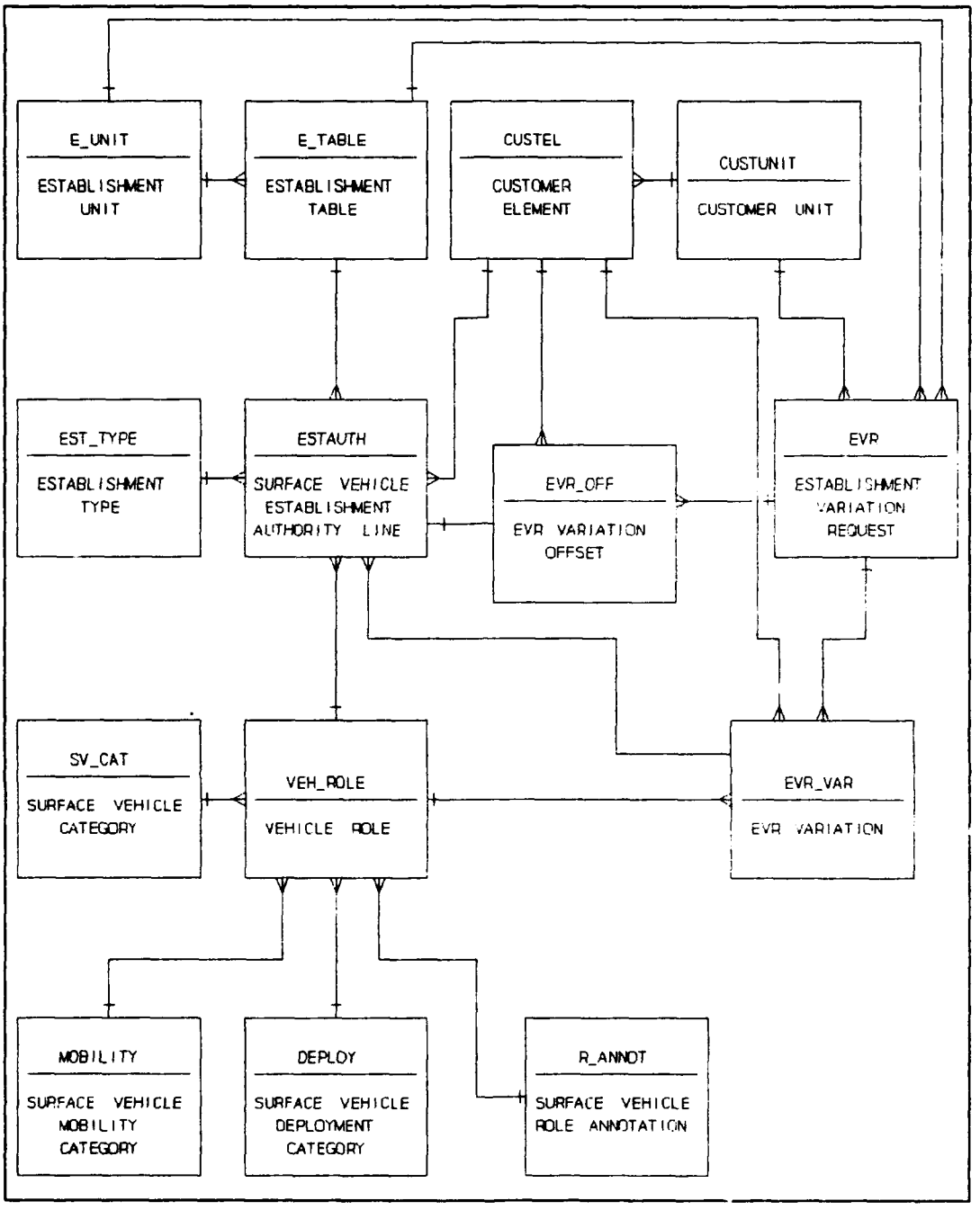

Figure 9. Establishment Entity Relationship Diagram

table may be grouped. Vehicle establishments allocated to RMSs usually belong to "UE" -- unit establishment.

Establishment Variation Request (EVR.DBF). An Establishment Variation Request (EVR) is the means by active units to apply for

variations of an MT establishment. This entity contains Leader information from an EVR.

Establishment Variation Request -- Offset (EVR_OFF.DBF). Details of what establishment authorities would be offset in lieu of a proposed increase on an MT establishment variation request are contained as records in this entity.

Establishment Variation Request -- Variation (EVR_VAR.DBF). This entity details the variation requested against an establishment authority or the number of vehicles for a new establishment authority.

Establishment Table (E_TABLE.DBF). An establishment table represents a grouping of establishment authorities for management purposes. An establishment table usually represents a geographic area and relates to one establishment unit. This entity contains the header information for a group of establishment authorities.

Establishment Unit (E_UNIT.DBF). Units are responsible for local management of the MT establishment and for provision of MT services. This would usually be a Base Squadron or Supply Support Squadron containing an RMS. E-UNIT.DBF provides information about that unit.

Mobility Category (MOBILITY.DBF). Mobility restrictions apply to many role codes that represent vehicle types. MOBILITY.DBF represents a table of these mobility restrictions.

Role Annotation (R_ANNOT.DBF). Special criteria exists for establishment of a vehicle type or role. This entity provides a table of authorised role annotations that detail the criteria.

Surface Vehicle Category (SV_CAT.DBF). Vehicle types or roles are generically grouped for management purposes; for example,

refueling vehicles or passenger carrying vehicles. SV-CAT.DBF represents a table of this grouping.

Vehicle Role Codes (VEH_ROLE.DBF). This entity details information about a specific classification of vehicle. This classification is known as a role code and is a subset of a larger surface vehicle category. An example is a light sedan or a 5 tonne general service truck. This entity also contains information pertinent to the establishment and replacement criteria applicable to each role code plus other management information.

Figure 9 illustrates the relationship between these entities. The corresponding EA list to this model is attached at Appendix C. The data dictionary, which explains each data attribute, is at Appendix B. The data to be stored in the databases represents the possible core for many other applications. Many of the elements maintained on the databases are not yet accessed by the reports in the application.

Forty international telephone calls accounted for the majority of communication between the investigator and the user. This represented a cost of approximately $US850.00 to the Australian Government. Where practical, a facsimile machine was used. Due to clarity of the final product or volume of documentation, mail had to be relied on. Mail packages sometimes took 14 days to reach the user. This tyranny of distance was compounded by time zones and other work priorities for both the user and the investigator.

The Event List was a difficult concept to convey to the user and the final list represents internal as well as external events. While the user had some exposure to DFDs, these were difficult to transmit by facsimile machine and explain by telephone. Nevertheless, both tools

were useful in definition of the broad scope and for providing the basis of a target document. Close proximity would have allowed the investigator to be present with documentation and examples of processes and screen designs. This would have allowed quicker development of interfaces and features.

All the code generating software used by the investigator relied on database definitions for code generation. The investigator's intention was to eliminate amendments to these data definitions prior to coding the applications. In hindsight, less emphasis could have been placed on developing the definitions and more time spent on early prototyping and screen design. This would have resulted in greater user participation and motivation in the early stages of the project, while resolving the data definitions problems that could not be foreseen when definitions were restricted to the data dictionary. This approach would have been more suitable if the investigator and user were in closer proximity.

A draft user manual explaining the features of the system and including screen captures would have provided a more suitable target document for this application. This would have provided the user with a clearer appreciation of the capabilities of the application. In the endeavour to document data requirements, this method was overlooked by the investigator.

Research Question Four.

Which data processes and information requirements can be improved by using a microcomputer database application?

Many areas of the management of RAAF MT have been identified for possible automation. The data processes that required automating were

identified in the Event List agreed with the user. All the processes centered around the ability to add, edit, and delete records on the databases plus the ability to produce reports from that information.

Additional Flexibility. One of the major criticisms of the current system was its inability to retrieve data in a timely, flexible manner. As documented in the Event List that forms part of the Target Document, the user requested additional flexibility in viewing the establishment. The following reports provide for this need:

a. MT Establishments by Mobility and Role Codes,

b. MT Establishments by Self Deployment Category and Role Codes,

c. MT Establishment Listing by Customer Unit and element,

d. Role Annotations,

e. Self Deployment Categories,

f. Mobility Categories,

g. All establishment types (Event List, Items 12 through 14), and

h. Amendments to establishment tables.

The following reports were omitted due to time constraints:

a. MT Establishments by Supply Source Classification and Role Codes (Event List, Item 15),

b. MT Establishment Tables for each Establishment Unit by Command (Event List, Item 16), and

c. MT Establishment Tables for each Customer Unit by Command (Event List, Item 16).

Even without the inclusion of the last three reports, the database application provides for far more flexibility than was available from the word-processed establishment tables, manual files, or Defence Instructions.

During loading of the databases, the application illustrated its ability to improve the accuracy of data records by highlighting errors of duplication in the current records.

Research Question Five.

Can appropriate computer programs be generated to meet those user requirements assessed as being most appropriate for automation?

As discussed in the answer to Question 4, Clipper™ application programs were generated to meet the requirements stated on the Target Document. Figures 4 through 8 provide an overview of the programs that form the application.

Code required for these functions exceeds 500 pages. Due to its size, the computer program code for the application has not been included in printed form in this thesis. A copy of the source code is available on 5.25 inch disk format. The User Manual at Appendix D provides a detailed explanation of the features of the application. The following represent some of the features that were included:

Pull-down Menus. Pull-down menus have been installed to allow the user to perform functions and to trace a path back to higher levels. There are two ways to activate a selection:

a. highlight the option by using the cursor or arrow keys on the keyboard, or

b. press the highlighted letter of the selection that is required.

The Help Selection. A brief explanation of functions is provided to the user for each section. The Help selection from the main menu provides a brief summary of the functions of each section. Comments are provided on each menu to assist the user. Menus in Delete

and Report functions provide explanations at the bottom left corner of the screen. These explanations change with each option highlighted. For more information about each function of ESTAB, refer to the user's manual, Appendix D.

Quitting an Operation. Application programs were designed so that the escape key is a common exiting mechanism. The user will be prompted for data entry as higher level menus appear.

Learning versus Development. Since the investigator was unaware of the power of many of the automated development tools, such as UI2™, it was difficult to forecast what could reasonably be achieved within the available time line. Learning how to use these unquestionably valuable software generators took many weeks and their full potential is still unknown. Time taken for sufficient learning was not adequately forecast at commencement of the thesis.

Research Question Six.

How can the application be validated to ensure successful implementation and acceptance by users?

Phase 6 evaluated the new application of the methodology. Selected AFIT personnel were requested to perform a technical review of the application (Fogg, 1990; Noble, 1990; Beard, 1990). DMOVT-AF assessed the usefulness and acceptance of the system. Interviews with personnel who have been exposed to the application formed the basis for data collection (Haren, 1990).

Evaluation (Acceptance Test). In evaluating ESTAB, DMOVT-AF was asked to consider speed and accuracy of the process, and access to information.

The following tasks were identified as being accomplished with ESTAB in minutes, when they each previously took between two hours and two days:

1. accessing establishment data,
2. analysing establishment types,
3. reviewing fleet composition,
4. review of fleet distribution,
5. updating establishment data, and
6. identifying vehicle role code data which was spread through many documents.

Manually producing the Consolidated MT Summary was estimated to have taken up to two weeks and could now be achieved in fifteen minutes.

ESTAB improved the accuracy of information as it avoided duplication of data and provided cross checking of tables. Data previously stored at DMOVT-AF in word-processed and manual files was now in a relational database format. The use of a relational DBMS provides a compact and efficient storage media. DMOVT-AF considered ESTAB to be a vast improvement in accessing information on current systems through the use of a composite database (Haren, 1990).

Despite the success of the application, the user identified a number of improvements that would make ESTAB more effective, user friendly, and assist in decision support. To improve effectiveness in assisting management of RAAF MT assets, ESTAB should be enhanced to include the following:

a. a form letter for the front of the establishment tables to reflect the latest amendments to that establishment table;

b. ad-hoc query function to allow identification of establishments that meet certain criteria in the form of a structured query language and report writer;

c. inclusion of command and geographic groupings of establishments to allow reporting in this manner;

d. consolidated summary of MT establishment amendments by role code, unit and value to allow trend analysis and constant monitoring; and

e. sub-totals for each role code on the individual unit establishment table reports.

While the user considered the pull down menus and other aspects of ESTAB very helpful, the following features would enhance the application's user friendliness:

a. inclusion of an ad-hoc query feature to allow selective viewing of database contents;

b. greater flexibility with report generation associated with ad-hoc queries;

c. selective reporting of the Consolidated MT Summary Report by individual role codes as the current format would be too large for a fully loaded database (95 role codes x 22 possible establishment units). The user also requested a total summary report by role code, but excluding the establishment unit detail; and

d. inclusion of date data showing when the estimated replacement price (ER-PRICE) on the vehicle role code record was updated, as this data is not subject to amendment list control.

The requirements for selective consolidated MT Summary reporting and ER-PRICE field update were met with version 1.3 of ESTAB. After seeing the capability of ESTAB to organise and store information, the

user saw potential for decision support applications. The ability to gather similar establishment authorities by some parameters would aid management decisions. Graphical representations would be especially suitable. With more emphasis on financial constraints, a decision support system (DSS) capability to value the establishments based on the estimated replacement cost of each vehicle role would be very useful. This would support a new management philosophy of delegating the management of establishments within a financial ceiling to individual commands.

Research Question Seven.

Does the proposed system provide improvements in efficiency when compared with current management practices?

Phase 6 of the methodology attempted to quantify any improvements in efficiency as a result of implementing the application. Telephone interviews conducted with the same group from Phase 1 resulted in the findings discussed under Research Question 6. The system improved the efficiency of MT establishment management by improving the speed and accuracy of data processing tasks associated with managing the RAAF MT establishment. Data is also more readily available in a readable format ready for direct incorporation into Defence Instructions, and as stand-alone reports (Haren, 1990).

Collection and analysis of user requirements usually requires face-to-face personal interviews, interaction, and observation. Attempting this task from another country is unusual and did prove difficult, especially when modeling user requirements not previously documented. These problems of distance and communication emphasise the requirement for rigor and accuracy during initial data gathering and

specification steps of this project. Time did not allow as many iterations of the review process in the formative stages, as was desired. However, relatively high levels of accuracy were still achieved. This was evidenced by the subsequent software meeting user requirements and improving efficiency.

The relational database organisation provides the basis for many other applications and has reduced the duplication of data to minimal levels. The process of documenting and normalizing the database provides the user with the information source for each data attribute (see Appendix B).

The user expects to complete loading the current database and have ESTAB fully implemented by December 1990. The full impact of improved efficiency at DMOVT-AF will be easier to appreciate following full implementation of ESTAB.

Summary

This chapter summarised the findings to research questions 3 through 7.

Research Question Three.

What are the data processing and information requirements for executive level RAAF MT asset management?

The data processes, relationships, and information that form this application can be seen as only a small element of what would comprise a larger integrated MIS. The establishment management information gathered reflects DMOVT-AF's concentration on higher level policy and establishment issues.

A Target Document, exploring the goals of the project, was developed and agreed with the user. A large ER diagram, illustrating the relationships of the data developed for establishment management at DMOVT-AF and that of a larger MIS was developed. Selected systems analysis tools expressed user requirements as models of processes, data relationships, and data definitions. These were developed into a Clipper™ application program and 14 relational databases.

Research Question Four.

Which data processes and information requirements can be improved by using a microcomputer database application?

Many areas were identified for automation. The processes with the most potential to improve efficiency at DMOVT-AF were agreed via the Target Document. These processes centered around the ability to add, edit, delete, and report information about MT establishments.

With the exception of three, all reports identified in the Target Document were developed. Inflexibility, one of the major criticisms of the current system, was addressed by the development of the relational database and these reports. Data accuracy was improved by eliminating duplication data via error routines in the application.

Research Question Five.

Can appropriate computer programs be generated to meet those user requirements assessed as being most appropriate for automation?

Blueprints of data relationships and processes were developed into databases and Clipper™ programs. A structured programming, top-down approach was used to develop modules to interact with the normalised database. Techniques were developed to protect data integrity and enhance user-friendliness. UI2™ and Relational Report Writer™ program

code generators were used to generate a large amount of the MT establishment management information system (ESTAB) application. Learning how to use these powerful tools required many weeks and their full potential remains unknown. Revisions of the application were forwarded to Australia for user evaluation.

Research Question Six.

How can the application be validated to ensure successful implementation and acceptance by users?

Cases based on user requirements were generated to test versions of ESTAB before they were dispatched to the user. Phase 6 of the methodology evaluated ESTAB using selected AFIT personnel and DMOVT-AF staff. The application's abilities were compared to the Target Document developed in Phase 1. DMOVT-AF was asked to consider speed and accuracy of the process, and access to information. The user stated that ESTAB had met his original requirements but stated a number of improvements would enhance ESTAB. Some of these enhancements were incorporated in version 1.3 of the application.

Research Question Seven.

Does the proposed system provide improvements in efficiency when compared with current management practices?

The user assessed that ESTAB improved the efficiency of MT establishment management by improving the speed and accuracy of data processing tasks associated with managing the RAAF MT establishment. Data was also more readily available in a readable format ready for direct incorporation into Defence Instructions, and as stand-alone reports.

V. Conclusions and Recommendations

Introduction

This chapter summarises the results of the research and recommends areas for follow on studies.

Summary

The goal of this research was to develop and evaluate a microcomputer application which would improve efficiency in data processing and management of the RAAF MT fleet at DMOVT-AF. According to user response, the goal of producing a successful prototype was achieved. The Motor Transport Establishment Management Information System (ESTAB) includes a converted database and user accepted application programs.

ESTAB improved the efficiency of MT establishment management by improving the speed and accuracy of data processing tasks associated with managing the RAAF MT establishment. Data was also more readily available in a readable format ready for direct incorporation into Defence Instructions, and as stand-alone reports. Version 1.3 of the application was implemented at DMOVT-AF on 19 July 1990. DMOVT-AF staff will complete database conversion and plan to have ESTAB fully operational by December 1990.

The user stated that ESTAB had met his original requirements, but stated a number of improvements would enhance ESTAB. While some enhancements were incorporated in Version 1.3 of the application, satisfaction of other requirements will require further research.

Recommendations for Further Research

Recommendations for further research focuses on four areas:

a. improving ESTAB to reflect additional user requirements,

b. automating vehicle despatch and administration functions to base Road Movement Sections (RMS),

c. automating the processing of establishment variation requests, and

d. developing decision support systems at all levels of MT management.

Improving the ESTAB Application. The scope of the thesis was limited by time. Chapter 4 lists a number of features that the user would like to see included in ESTAB. The database would need to be expanded to accommodate these changes.

New management practices concentrating on financial information and related to program budgeting are being developed. ESTAB will need to be enhanced once those procedures are finalised.

ESTAB can be used to add, edit, delete, and report MT establishment information. The relational database invites the development of other applications at DMOVT-AF to utilize all included data.

Automating RMS Vehicle Despatch and Administration. Research illustrated that efficiency benefits will also occur if applications are developed for lower MT asset management areas. The daily functions of an RMS are data intensive. Vehicle fleets of over 200 vehicles must be coordinated and despatched daily. Data records are all manually maintained and reports for higher management levels must be hand generated. The MT management information entity relationship diagram at Appendix E illustrates the important data groupings that may be included in such a system. This system would need to interface with ESTAB to

allow access to establishment information and provide DMOVT-AF and Commands with valuable usage data.

Automation of Establishment Variation Requests. The rational for the initial establishment of numbers of vehicles for a vehicle type is recorded on paper files and cannot be retrieved. Customer units are often required to re-justify the requirements for establishment in times of verification or query of entitlement. This places an unnecessary burden on all levels of management involved in the collection and analysing process. Additionally, the lack of access to this information deprives all levels of MT management of information necessary for control of vehicle use. Vehicles are often employed for purposes for which they were not intended. Staff turnover, at all management levels, coupled with the poor accessibility of establishment variation request (EVR) information allows this information to be lost over time. Capture of this information on a retrievable media at the time of EVR submission would also assist tracking of submission and allow answering of processing status queries. Development of the facet of a complimentary system to ESTAB is feasible once data processing at the RMS level has been automated. Development before this important step would mean unnecessary data entry and lessen system data integrity. Eventually such a system may allow desk-top review of establishments using RMS supplied data and establishment usage requirements by vehicle type.

Developing DSSs. All DSSs require a database (Davis, 1988:75). Models can be developed to analyse this information and assist decision making. The area of expert systems provides great potential for use of this data in conjunction with heuristics to aid management. A prototype system using the ESTAB database was developed by the investigator using

VP-EXPERT™ software (Holden-Day, 1988). The Establishment Valuation Request Advisor (EVRA) illustrated the ability to develop input systems that emulate human expertise and allow that expertise to be shared throughout an organisation. Many other applications could be developed at all levels of MT asset management along similar lines.

User interfaces that utilize graphics could be used to enhance views of current information managed by ESTAB and allow what-if calculations. Use of a structured query language in conjunction with this form of interface would provide management with a powerful tool for decision making.

Appendix A: Target Document

This document describes the details of the project life cycle and the agreed goal and objectives of the new system. Details of the project life cycle were transmitted via a copy of the draft methodology. Details were updated via telephone conversations.

The Target Document was developed from the initial context DFD at Figure A-1 and event list at Table A-1. It represents an agreement between the user and the investigator of what should be included in the project scope.

The Initial Context DFD represented the information requirements of the proposed system as they relate to the organisational elements defined in Chapter II. The Event List was a narrative list of all the events that occur outside the system to which the system must respond.

Scope. The investigator and user agreed on the scope of the project throughout the use of a Context Diagram and Event List. The thesis will only address the establishment management requirements for DMOVT-AF and not those of SG3. The agreed requirements for ESTAB are detailed below.

Data Maintenance Functions. ESTAB is to provide the ability to add, modify, and delete all establishment data including the following:

a. establishment tables,

b. surface vehicle categories,

c. vehicle role codes and their policy details,

d. mobility categories,

e. self-deployment categories,

Event List

Item	Description
1.	HQLC (AEENG5) modifies the role of a vehicle type. (F)
2.	An Air Force Operational Directive (AFOD) issued by Air Force Office creates a new unit (customer) which requires MT support. (F)
3.	Air Force Office issues an AFOD which disbands a unit (customer) established for MT. (F)
4.	A customer unit places an EVR through its establishment unit and parent command to alter its vehicle establishment. (F)
5.	A customer queries what vehicles are established for its use. (F)
6.	Air Fore Office changes a customer unit's host establishment unit. (F)
7.	A Command, RMS or customer unit asks about the status of an EVR. (F)
8.	Air Force Office asks details about a vehicle type. (F)
9.	Air Force Office changes the location of an establishment unit. (F)
10.	Air Force Office adds a new mobility/deployment requirement for vehicles. (F)
11.	The ADF deletes a mobility/deployment requirement for vehicles. (F)
12.	A new establishment type is established by Air Force Office policy. (F)
13.	An existing establishment type is modified by the Air Force Office policy. (F)
14.	An existing establishment type is deleted by ADF policy. (F)
15.	HQADF (ACLOG) wants to know where all the vehicles of a supply source classification, such as commercial line, are established and what are their tasks. (F)

Table A-1 (Cont'd)

Item	Description
16.	A RMS requests a printout of their establishment. (F)
17.	SG3 requires an annual listing of all vehicle types established by location. (T)

Legend:

(T) denotes temporal events. These are events triggered by the passage of time.

(F) denotes flow-orientated events. These are events caused by the arrival of some information to the system.

f. establishment role restrictions or annotations for vehicle roles,

g. customers allocated vehicles, and

h. units authorised to hold and manage establishments.

Output. ESTAB is to provide reports -- display and print -- of all current reports required by DMOVT-AF. (The numbers refer to the Event List reference.) Specifically the following:

a. MT Establishment Tables for each Establishment Unit (16)

b. Consolidated listing of all establishments by Role Code (18,19),

c. MT Establishment and Replacement Criteria (Annex C to Chapter 15 DI(AF)AAP 3635.001).

Additional Flexibility. Users requested additional flexibility in viewing the establishment. The following reports provide for some of this need:

a. MT Establishments by Mobility and Role Codes,

b. MT Establishments by Self Deployment Category and Role Codes,

c. MT Establishment Listing by Customer Unit and element,

d. Role Annotations,

e. Self Deployment Categories,

f. Mobility Categories,

g. MT Establishments by Supply Source Classification and Role Codes (Event List Item 15),

h. MT Establishment Tables for each Establishment Unit by Command (Event List Item 16),i. MT Establishment Tables for each Customer Unit by Command (Event List Item 16),

j. All establishment types (Event List Items 12 through 14), and

k. Amendments to establishment tables.

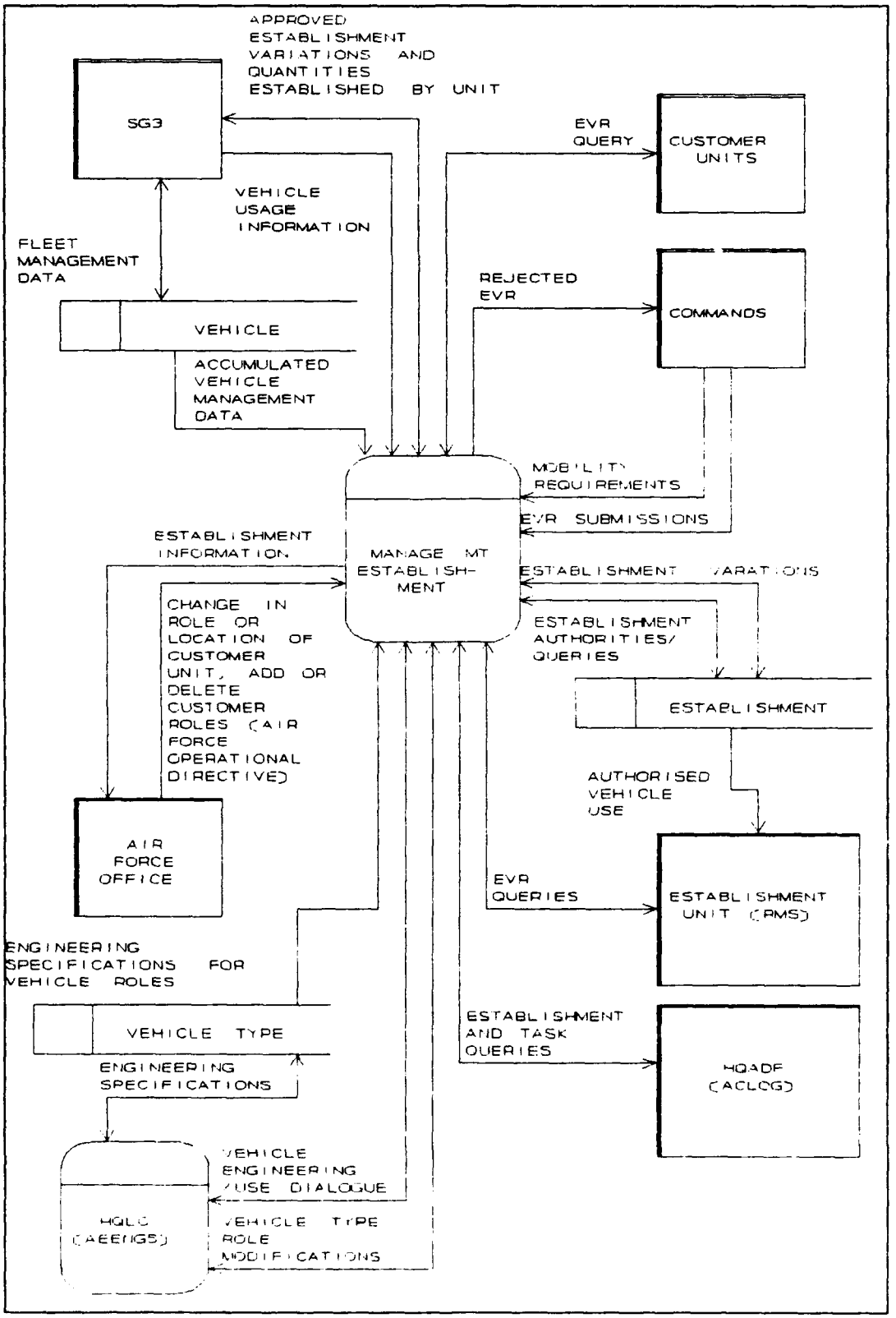

Figure A-1. Initial Context Data Flow Diagram

Appendix B: Establishment MIS Data Dictionary

Introduction

The following list is the data dictionary of the Establishment Management Information System (ESTAB). It was developed using Aston Tate's dBase III Plus™. The report was generated using Relational Report Writer™ software and represents all the data elements or fields used in the application. An explanation of the terms follows.

"Data attribute name" is the abbreviated name of 10 characters used in Clipper™ programs and associated databases. "Format" denotes the form of allowable character representation in the database. A numeric field is denoted by a "9". An "A" denotes only alphabetic characters. Any character is denoted by an "X". The number in parenthesis that follows these symbols denotes the number of that type of character; for example "99" is the same as "9(2)". An "S" denotes that positive and negative values must be represented. A "V" denotes positioning of the decimal point for numeric values.

"Full name" is the common title of the attribute. "Description" is a short description of the field contains. The "Domain" represents the valid values expected at the time of input or update of that attribute. "None specified" in this area means that no specific values were specified for validation purposes.

The "Purpose" of the data attribute denotes why it was included in the database and application. "Entity" denotes where the data attribute resides in the database following the developmental process of normalization. Where data attributes act as links or keys to other entities and their attributes, the data attribute will be repeated.

This redundancy is necessary to allow the representation of relationships between data groups. When a data attribute acts in this manner, "Purpose" will denote that it is a "foreign key" to another entity. When an attribute is used to uniquely identify an occurrence of an entity, it is referred to as a "primary key".

"Source of the data requirement" denotes where the requirement to include the attribute originated. "Source of raw data" denotes where the current data can be found to convert to the new database.

Data Dictionary of Attributes in Alphabetical Sequence

Data Attribute Name: AIRPORTABI Format: X(3)
Full Name: Airportability
Description: Indicates whether airportability is mandatory or not for a particular role code.
Domain: yes,no
Purpose: Allows management of vehicle airportability by role code.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP7070.014 paragraph 110 AL1
Source of raw data for database: DI(AF)AAP7070.014 paragraph Chapter 4 AL1

Data Attribute Name: CAMOUFLAGE Format: X(3)
Full Name: Approval for Camouflage
Description: Indicates if Air Force Office (DMOVT-AF) has approved application of camouflage colours to the role code.
Domain: yes,no
Purpose: Allows standard management of camouflage by role code.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP7070.014 paragraph 113
Source of raw data for database: DI(AF)AAP7070.014 Chapter 4

Data Attribute Name: CMD_REF Format: X(40)
Full Name: Command File Reference
Description: The file reference used by the parent command in correspondence relating to the EVR.
Domain: None specified
Purpose: Allows cross-referencing of correspondence to EVRs.
Entity: EVR
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: EVRs, Commands

Data Attribute Name: CUSTADDRES Format: X(50)
Full Name: Customer Address
Description: The address of the customer unit requesting transport support services or assets.
Domain: None specified
Purpose: Identifies the location for mailing correspondence of a unit requesting support.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP 5131.001

Data Attribute Name: CUSTEL_ID Format: X(15)
Full Name: Customer Element Identifier
Description: A term used to uniquely identify a customer unit element.
Domain: None specified
Purpose: Allows unique identification of customer elements within a unit.
Entity: CUSTEL
Source of data requirement: DMOVT-AF
Source of raw data for database: EVR annotations

Data Attribute Name: CUSTEL_ID Format: X(15)
Full Name: Customer Unit Element Identifier
Description: A term used to uniquely identify a customer unit element.
Domain: None specified
Purpose: Denotes the unit element that requires the EVR offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTEL_ID Format: X(13)
Full Name: Customer Element Identifier
Description: A term used to uniquely identify a customer unit element.
Domain: None specified
Purpose: Denotes the customer unit for the establishment authority.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTEL_ID Format: X(15)
Full Name: Customer Element Identifier
Description: A term used to uniquely identify a customer unit element.
Domain: None specified
Purpose: Identifies unit element that requires EVR-offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTEL_ID Format: X(15)
Full Name: Customer Unit Element Identifier
Description: A term used to uniquely identify a customer unit element.
Domain: None specified
Purpose: Part of the primary key of EVR to which the variation belongs.
Entity: EVR_VAR
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTEL_NAM Format: X(30)
Full Name: Customer Element Name
Description: The full name of the element of a unit that requires MT support.
Domain: None specified
Purpose: Allows confirmation of selection of customer element abbreviations.
Entity: CUSTEL
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTEL_PH Format: 9(5)
Full Name: Customer Element Phone Extension
Description: The telephone extension for a point of contact at the unit element requesting transport services or assets.
Domain: None specified
Purpose: Allows direct contact with the point of contact at the customer unit.
Entity: CUSTEL
Source of data requirement: DMOVT-AF
Source of raw data for database: Customer Unit

Data Attribute Name: CUSTROLE Format: X(30)
Full Name: Customer Unit Role
Description: The designated role of the customer unit.
Domain: None specified
Purpose: Identifies the roles performed by the customer unit that may require transport.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: ACD 171

Data Attribute Name: CUSTU_SNAM Format: X(15)
Full Name: Customer Unit Short Name
Description: Uniquely identifies a military unit by a fifteen letter short name.
Domain: None specified
Purpose: Denotes the parent unit of a customer element.
Entity: CUSTEL
Source of data requirement: DMOVT-AF
Source of raw data for database: Investigator

Data Attribute Name: CUSTU_SNAM Format: X(15)
Full Name: Customer Unit Short Name
Description: Uniquely identifies a military unit by a fifteen letter short name.
Domain: None specified
Purpose: Unit requesting Establishment Variation Request (EVR).
Entity: EVR
Source of data requirement: DI(AF)AAP3631.001 Chapter 15 Annex A
Source of raw data for database: DMOVT-AF

Data Attribute Name: CUSTU_SNAM Format: X(5)
Full Name: Customer Unit Short Name
Description: Uniquely identifies a military unit by a fifteen letter short name.
Domain: None specified
Purpose: Allows requirements, usage and requests to be matched to a particular unit.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: RMS/DMOVT-AF

Data Attribute Name: CUSTU_TITL Format: X(30)
Full Name: Customer Unit Full Title
Description: The formal title of a unit that requires MT support.
Domain: None specified
Purpose: Allows recognition of a unit by its full title.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database:

Data Attribute Name: CUST_ID Format: X(5)
Full Name: Customer Unit Designator Code
Description: A five digit code that uniquely identifies a customer unit.
Domain: None specified
Purpose: Will allow identification by unique ADF-wide code.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database:

Data Attribute Name: DATE_E_AMD Format: dd/mm/yy
Full Name: Date Establishment Table Last Amended
Description: The date the establishment table was last amended.
Domain: None specified
Purpose: Allows recording of when an establishment table was last updated.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: DATE_E_CRE Format: dd/mm/yy
Full Name: Date Establishment Table Created
Description: The calendar date that the establishment table was created.
Domain: None specified
Purpose: Allows history capture of an establishment table for a unit.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: DATE_L_AMD Format: dd/mm/yy
Full Name: Date Establishment Line Last Amended
Description: The date that the establishment line was last amended.
Domain: None specified
Purpose: Allows recording of when establishment lines are amended for amendment lists.
Entity: ESTAUTH
Source of data requirement: Investigator
Source of raw data for database: DMOVT-AF

Data Attribute Name: D_PRICE_ER Format: dd/mm/yy
Full Name: Date Estimated Replacement Price Updated
Description: The date when the estimated replacement price was last updated.
Domain: None specified
Purpose: Allows accuracy of the PRICE_ER field to be validated.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF post Beta test.
Source of raw data for database: DMOVT-AF during update.

Data Attribute Name: ESTAUTHRMK Format: X(30)
Full Name: Establishment Authority Remarks
Description: A field that contains remarks that pertain to the reason for a particular establishment authority.
Domain: None specified
Purpose: Allows recording of information pertaining to the establishment of a vehicle.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: Current Establishment Records

Data Attribute Name: EST_DATE Format: dd/mm/yy
Full Name: Establishment Date
Description: The calendar date when this establishment authority was last amended.
Domain: None specified
Purpose: Allows capture of update transactions and could provide a catalyst for review.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_LINE Format: 9(3)
Full Name: Establishment Line
Description: A number that uniquely identifies an establishment authority within an establishment table for an establishment type.
Domain: 1 to 999
Purpose: To allow separate access to lines on an establishment that relate to a vehicle.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_LINE Format: 9(3)
Full Name: Establishment Line Identifier
Description: A number that uniquely identifies an establishment authority within an establishment table for an establishment type.
Domain: None specified
Purpose: Part of the key to ESTAUTH and assists in unique identification of an EVR offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_TYPE Format: X(2)
Full Name: Establishment Type
Description: Denotes the type of establishment authority.
Domain: None specified
Purpose: Part of unique identifier of an establishment authority.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_TYPE Format: X(2)
Full Name: Establishment Type
Description: Denotes the type of establishment authority.
Domain: None specified
Purpose: Part of the unique identifier of an EVR offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_TYPE Format: X(2)
Full Name: Establishment Type
Description: Denotes the type of establishment authority.
Domain: UE,TE,DS,OE
Purpose:
Entity: EST_TYPE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EST_TYPE_D Format: X(20)
Full Name: Establishment Type Description.
Description: Describes the type of establishment.
Domain: None specified
Purpose:
Entity: EST_TYPE
Source of data requirement: DI(AF)AAP3631.001
Source of raw data for database: DMOVT-AF

Data Attribute Name: EUNAME Format: X(10)
Full Name: Establishment Unit Name
Description: The short name given to an establishment unit to allow identification.
Domain: None specified
Purpose: Allows easy identification of an establishment unit.
Entity: E_UNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EU_ADDRESS Format: X(50)
Full Name: Establishment Unit Address
Description: The postal address of a unit responsible for local MT establishment management.
Domain: None specified
Purpose: Provides the location of the unit responsible for managing MT elements.
Entity: E_UNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP 5131.001

Data Attribute Name: EU_FILEREF Format: X(40)
Full Name: Establishment Unit File Reference
Description: The file reference quoted on the EVR, used by the establishment unit for cross-reference.
Domain: None specified
Purpose: Allows recording of unit cross-references.
Entity: EVR
Source of data requirement: EVR
Source of raw data for database: DMOVT-AF,RMS,EVR

Data Attribute Name: EU_NAME Format: X(10)
Full Name: Establishment Unit Name
Description: The abbreviated title of the unit supplying local transport assets and transport management services.
Domain: None specified
Purpose: Identifies the local manager of vehicle assets.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EVR_DATE Format: dd/mm/yy
Full Name: Date EVR Submitted
Description: The date an EVR was submitted to a host unit for processing.
Domain: None specified
Purpose: Allows tracking of EVRs and identification.
Entity: EVR
Source of data requirement: DI(AF)AAP3631.001
Source of raw data for database: RMS/DMOVT-AF

Data Attribute Name: EVR_OFFRMK Format: X(50)
Full Name: EVR Offset Remarks
Description: Remarks made against a particular offset on an EVR.
Domain: None specified
Purpose: Allows capture of comments at the individual offset level of an EVR.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: EVR_RMKS Format: X(200)
Full Name: Establishment Variation Request Remarks
Description: Remarks made concerning the entire establishment request.
Domain: None specified
Purpose: Allows remarks concerning the entire EVR to be recorded.
Entity: EVR
Source of data requirement: DI(AF)AAP3631.001 15 A
Source of raw data for database: DMOVT-AF

Data Attribute Name: EVR_TASK Format: X(100)
Full Name: Nature of Tasking for EVR Variation
Description: Denotes the nature of the task that relates to the requirement for EVR variation.
Domain: None specified
Purpose: Allows capture of information about each variation.
Entity: EVR_VAR
Source of data requirement: DI(AF)AAP3631.001 15 A
Source of raw data for database:

Data Attribute Name: EVR_VARQTY Format: S9(3)
Full Name: EVR Variation Quantity
Description: The quantity of the SVI requiring variation.
Domain: None specified
Purpose: Allows the number of vehicles in an EVR to be quantified.
Entity: EVR_VAR
Source of data requirement: DI(AF)AAP3631.001 15 A
Source of raw data for database: customer unit

Data Attribute Name: E_AMEND_NO Format: 9(3)
Full Name: Establishment Table Amendment Number
Description: Denotes the current version of an establishment table for a unit.
Domain: None specified
Purpose: Allows current and previous establishment tables to be identified.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_FILE_REF Format: X(4)
Full Name: Establishment Table File Reference
Description: Identifies the establishment table for a unit established to hold and manage MT assets.
Domain: None specified
Purpose: Allows grouping of establishment authorities together for management purposes.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_FILE_REF Format: X(4)
Full Name: Establishment Table File Reference
Description: Identifies the establishment table for a unit established to hold and manage MT assets.
Domain: None specified
Purpose: Assists to uniquely identify an EVR Offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_FILE_REF Format: X(4)
Full Name: Establishment Table File Reference
Description: Identifies the establishment table for a unit established to hold and manage MT assets.
Domain: None specified
Purpose: Denotes the establishment table that the EVR seeks to amend.
Entity: EVR
Source of data requirement: DI(AF)AAP3631.001 15
Source of raw data for database: DMOVT-AF (EVR)

Data Attribute Name: E_FILE_REF Format: X(4)
Full Name: Establishment Table File Reference
Description: Identifies the establishment table for a unit established to hold and manage MT assets.
Domain: None specified
Purpose:
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_UNIT_EXT Format: 9(5)
Full Name: Establishment Unit Telephone Contact Extension
Description: The Base telephone extension for the position responsible for local MT establishment management.
Domain: None specified
Purpose: Allows recording of the contact telephone extension for each Establishment Unit.
Entity: E_UNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_UNIT_ID Format: X(5)
Full Name: Establishment Unit Identifier
Description: An abbreviation allocated to a unit that is locally responsible for MT establishment management.
Domain: None specified
Purpose: Uniquely identifies a unit where an establishment is allocated.
Entity: E_UNIT
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_UNIT_ID Format: X(5)
Full Name: Establishment Unit Identifier
Description: An abbreviation allocated to a unit that is locally responsible for MT establishment management.
Domain: None specified
Purpose: Denotes the establishment unit or RMS where an EVR was initially processed.
Entity: EVR
Source of data requirement: DI(AF)AAP 3631.001 Chapter 15
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_UNIT_ID Format: X(5)
Full Name: Establishment Unit Identifier
Description: An abbreviation allocated to a unit that is locally responsible for MT establishment management.
Domain: None specified
Purpose: Provides a means of grouping together establishments for management purposes.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: E_WEF_DATE Format: dd/mm/yy
Full Name: Establishment Table With Effect Date
Description: The calendar date from which the current amendment of the establishment table will take effect.
Domain: None specified
Purpose: Allows grouping of establishment authorities together for management purposes.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: FAD Format: 9(1)
Full Name: Force Activity Designator
Description: The Force Activity Designator of the unit that requires transport services or assets.
Domain: None specified
Purpose: Use to determine priority of satisfaction of requests for transport support.
Entity: CUSTUNIT
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(G)SUP 16-1

Data Attribute Name: ILM_VENUE Format: X(4)
Full Name: Intermediate Level Maintenance Venue
Description: Denotes where intermediate level maintenance is to occur.
Domain: RAAF, CONT
Purpose: Allows management of maintenance of vehicle role categories.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP7070.014 paragraph 109 AL1
Source of raw data for database: DI(AF)AAP7070.014 paragraph 109 AL1, DMP

Data Attribute Name: LASTREVIEW Format: dd/mm/yy
Full Name: Last Review Date
Description: The calendar date when the establishment authority was last reviewed.
Domain: None specified
Purpose: Allows recording of the dates when DMOVT-AF last reviewed the establishment.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: LIC_CODE Format: X(2)
Full Name: Licence Code
Description: The code used to distinguish groups of vehicles for driver licencing purposes.
Domain: None specified
Purpose: Allows management of manpower and driver licencing considerations.
Entity: VEH_ROLE
Source of data requirement: DI(AF)3631.001 Chapter 7
Source of raw data for database: DMOVT-AF

Data Attribute Name: LOTKM Format: 9(6)
Full Name: Life of Type Kilometers
Description: The number of kilometers at which a vehicle type is deemed ready for disposal.
Domain: None specified
Purpose: Used for the determination of disposal and establishment authority decisions.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Data Attribute Name: LOTYEARS Format: 9(2)
Full Name: Life of Type - Years
Description: The statutory age of a vehicle type when ready for disposal.
Domain: None specified
Purpose: Used to determine the disposal dates for individual vehicles.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)3631.001 Chapter 15

Data Attribute Name: L_WEF_DATE Format: dd/mm/yy
Full Name: Establishment Authority Line With Effect Date
Description: The date from which an Establishment Authority Line take effect.
Domain: None specified
Purpose: Allows specification of establishments in advance of requirements.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: MAX_CARGO Format: 9(5)
Full Name: Maximum Cargo
Description: The maximum weight expressed in kilograms that may be carried as cargo for this role code.
Domain: None specified
Purpose: Allows vetting of EVR and other requirements for a requirement to carry cargo.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Data Attribute Name: MAX_LITRES Format: 9(9)
Full Name: Maximum Litres Bulk Liquid Cargo
Description: The maximum allowable amount of bulk liquid cargo that may be carried by the role code.
Domain: None specified
Purpose: Allows determination of requirements that involve the need to carry bulk liquids
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Data Attribute Name: MAX_PAX Format: 9(2)
Full Name: Maximum Passengers
Description: The maximum number of passengers allowed to be transported by the vehicle role code.
Domain: None specified
Purpose: Allows accurate assessments of EVR submission and other requirements.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Data Attribute Name: MOBCAT Format: 9(1)
Full Name: Mobility Category
Description: Denotes the mobility capabilities of a vehicle role.
Domain: None specified
Purpose:
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 15
Source of raw data for database: DMOVT-AF

Data Attribute Name: MOBCAT Format: 9(1)
Full Name: Mobility Category
Description: Describes the mobility capabilities of a vehicle role.
Domain: 1 TO 4 -SEE ANNEX C Chapter 15 DI(AF) AAP 3635.001
Purpose:
Entity: MOBILITY
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15 Annex C

Data Attribute Name: MOBCAT_DES Format: X(150)
Full Name: Mobility Category Description
Description: Narrative describing the mobility characteristics of a vehicle type.
Domain: None specified
Purpose:
Entity: MOBILITY
Source of data requirement: DI(AF)AAP3631.001 15 C
Source of raw data for database: DMOVT-AF

Data Attribute Name: NSN Format: 9(13)
Full Name: NATO Stock Number
Description: Uniquely identifies each item of supply.
Domain: None specified
Purpose:
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: SG3

Data Attribute Name: PRICE_ER Format: 9(6)
Full Name: Estimated Replacement Price
Description: The estimated dollar replacement cost for a particular vehicle type.
Domain: None specified
Purpose: Budgetary projections.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: SG3

Data Attribute Name: QTYEST Format: 9(3)
Full Name: Establishment - Quantity
Description: Denotes the number of the vehicle type established against an Establishment Authority.
Domain: None specified
Purpose: Denotes the quantity of a vehicle type against an establishment type.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: QTY_OFFSET Format: s9(3)
Full Name: Role Code Quantity Offset
Description: The quantity of the role code, identified on a current establishment authority that is identified as an offset on a EVR.
Domain: None specified
Purpose: Allows the number of vehicles to be specified in an EVR offset.
Entity: EVR_OFF
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: EVR

Data Attribute Name: RADIO Format: X(3)
Full Name: Radio Required
Description: Denotes if a radio is required as part of the role code configuration.
Domain: FFR
Purpose: Allows identification of role codes configured for radios.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Data Attribute Name: ROLE_CODE Format: X(3)
Full Name: Surface Vehicle Role Code
Description: Uniquely identifies each generic vehicle role with a three letter code, which are the first three letters of an SVI.
Domain: Alphas only.
Purpose: Allows unique identification of generic vehicle types.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001
Source of raw data for database: AEENG5

Data Attribute Name: ROLE_CODE Format: X(3)
Full Name: Surface Vehicle Role Code
Description: Uniquely identifies each generic vehicle role with a three letter code, which are the first three letters of an SVI.
Domain: None specified
Purpose: Assists in uniquely identifying an EVR Offset.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: ROLE_CODE Format: X(3)
Full Name: Surface Vehicle Role Code
Description: Uniquely identifies each generic vehicle role with a three letter code, which are the first three letters of an SVI.
Domain: None specified
Purpose: Allows back-reference to the EVR Variation that originally established line.
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: ROLE_CODE Format: X(3)
Full Name: Surface Vehicle Role Code
Description: Uniquely identifies each generic vehicle role with a three letter code, which are the first three letter of an SVI.
Domain: None specified
Purpose: Denotes the vehicle type established against that establishment.
Entity: ESTAUTH
Source of data requirement: Establishment Tables
Source of raw data for database: DMOVT-AF

Data Attribute Name: ROLE_CODE Format: X(3)
Full Name: Surface Vehicle Role Code
Description: Uniquely identifies each generic vehicle role with a three letter code, which are the first three letters of an SVI.
Domain: None specified
Purpose: Uniquely identifies an EVR variation and relates it to a specific SVI.
Entity: EVR_VAR
Source of data requirement: DI(AF)AAP3631.001 15 A
Source of raw data for database: RMS/DMOVT-AF

Data Attribute Name: ROLE_DESC Format: X(50)
Full Name: Surface Vehicle Role Code Description
Description: Describes each surface vehicle role code.
Domain: None specified
Purpose: Allows capture of descriptor information.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP 7010.014

Data Attribute Name: R_ANNOTATE Format: X(1)
Full Name: Role Annotation
Description: Describes the special criteria for establishment of a vehicle type or role.
Domain: None specified
Purpose:
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: R_ANNOTATE Format: X(1)
Full Name: Role Annotation
Description: Describes the special criteria for establishment of a vehicle role or type.
Domain: None specified
Purpose: Allows special information to be represented against certain vehicle roles.
Entity: R_ANNOT
Source of data requirement: DI(AF)AAP 3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP 3631.001

Data Attribute Name: R_ANNOT_D Format: X(120)
Full Name: Role Annotation Description
Description: Describes an annotation code concerning the special criteria required for establishment of a vehicle type or role.
Domain: None specified
Purpose: Allows description of a special vehicle role characteristics.
Entity: R_ANNOT
Source of data requirement: DI(AF)AAP3631.001 Chapter 15 Annex C
Source of raw data for database: DI(AF)AAP3631.001

Data Attribute Name: SELFDEP Format: X(2)
Full Name: Self Deployment Code
Description: Describes the restrictions regarding deployment of a vehicle type.
Domain: See ANNEX C to Chapter 15 of DI(AF)AAP3635.001
Purpose:
Entity: DEPLOY
Source of data requirement: DI(AF)AAP3631.001 15 C
Source of raw data for database: DMOVT-AF

Data Attribute Name: SELFDEP Format: X(2)
Full Name: Self Deployment Code
Description: Describes the restrictions regarding deployment of a vehicle type.
Domain: None specified
Purpose:
Entity: VEH_ROLE
Source of data requirement: DI(AF)3631.001 15
Source of raw data for database: DMOVT-AF

Data Attribute Name: SELFDEP_D Format: X(145)
Full Name: Self Deployment Code Description
Description: Description of a code that describes the ability of a vehicle to self-deploy.
Domain: None specified
Purpose:
Entity: DEPLOY
Source of data requirement: DI(AF)AAP3631.001 15 A
Source of raw data for database: DI(AF)AAP3631.001

Data Attribute Name: STDISN_REQ Format: X(3)
Full Name: Standardisation Required
Description: Denotes the requirement to standardise the procurement in the role code.
Domain: None specified
Purpose: To meet supply or engineering support requirements.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP7070.014 paragraph 114 AL1
Source of raw data for database: DI(AF)AAP7070.014 Chapter 4

Data Attribute Name: STD_COLOUR Format: X(10)
Full Name: Standard Colour
Description: The standard colour for the vehicle role category.
Domain: None specified
Purpose: Allows management of vehicle colours by role code.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP7070.014 paragraph 112 AL1
Source of raw data for database: DI(AF)AAP7070.014 Chapter 4

Data Attribute Name: SUP_SOURCE Format: X(6)
Full Name: Vehicle Supply Source Category
Description: Denotes the management category to which a particular vehicle type belongs.
Domain: COM, COM-CL, NCOM
Purpose: Used to manage acquisition and disposal of vehicles by role code.
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP7010.014

Data Attribute Name: SV_CAT Format: X(2)
Full Name: Surface Vehicle Category
Description: Denotes the generic grouping of roles.
Domain: None specified
Purpose: Relates a vehicle role code to a category.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 paragraph 104
Source of raw data for database: DI(AF)AAP3631.001 Chapter 4

Data Attribute Name: SV_CAT Format: X(2)
Full Name: Surface Vehicle Category
Description: Denotes a generic grouping of vehicle roles.
Domain: None specified
Purpose: Allows grouping of vehicle roles for management purposes.
Entity: SV_CAT
Source of data requirement: DI(AF)AAP7070.014 paragraph 104
Source of raw data for database: DI(AF)AAP7070.014 Chapter 3

Data Attribute Name: SV_CAT_DES Format: X(45)
Full Name: Surface Vehicle Category Description
Description: Describes a generic category of surface vehicle role.
Domain: None specified
Purpose: Allows description of a surface vehicle category.
Entity: SV_CAT
Source of data requirement: DI(AF)AAP7070.014 Chapter 4
Source of raw data for database: DI(AF)AAP7070.014 Chapter 4

Data Attribute Name: SYS_ENG Format: X(4)
Full Name: Systems Engineer
Description: The HQLC systems engineer contact point for engineering management of role code.
Domain: None specified
Purpose: Allows differentiation between engineering elements responsibilities at HQLC.
Entity: VEH_ROLE
Source of data requirement: DI(AF)7070.014 paragraph 115 AL1
Source of raw data for database: DI(AF)7070.014 Chapter 4

Data Attribute Name: UTIL_PRAM Format: 9.9
Full Name: Establishment Utilisation Parameter
Description: A fraction used by DMOVT-AF in the calculation of acceptable vehicle utilisation for establishment locations.
Domain: None specified
Purpose: Allows flexibility of management of establishments by location factors.
Entity: E_TABLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: V_FILE_REF Format: X(40)
Full Name: EVR File Reference
Description: The file reference of the originator of an EVR.
Domain: None specified
Purpose: Used to assist in uniquely identifying separate EVR submissions from a customer.
Entity: EVR
Source of data requirement: DMOVT-AF /DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: RMS/DMOVT-AF

Data Attribute Name: V_FILE_REF Format: X(4)
Full Name: EVR File Reference
Description: The file reference of the originator of an EVR.
Domain: a(2)9(2)
Purpose:
Entity: ESTAUTH
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: V_FILE_REF Format: X(40)
Full Name: EVR File Reference
Description: The file reference of the originator of an EVR.
Domain: None specified
Purpose: Links an EVR line to its parent EVR.
Entity: EVR_VAR
Source of data requirement: DMOVT-AF/DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DMOVT_AF

Data Attribute Name: V_FILE_REF Format: X(40)
Full Name: EVR File Reference
Description: The file reference of the originator of an EVR.
Domain: None specified
Purpose: Links an offset to its parent EVR.
Entity: EVR_OFF
Source of data requirement: DMOVT-AF
Source of raw data for database: DMOVT-AF

Data Attribute Name: V_OP_CLASS Format: X(4)
Full Name: Vehicle Operational Classification
Description: A vehicle's operational classification as defined in DI(AF) TECH 17-15.
Domain: OPTV, NOTV
Purpose:
Entity: VEH_ROLE
Source of data requirement: DMOVT-AF
Source of raw data for database: DI(AF)AAP7070.014 Chapter 4

Data Attribute Name: V_WEF_DATE Format: dd/mm/yy
Full Name: EVR With Effect Date
Description: The date that an EVR variation is requested to be effective from.
Domain: None specified
Purpose: Allows a variation request to be processed before the requirement must be filled
Entity: EVR_VAR
Source of data requirement: DI(AF)AAP3631.001
Source of raw data for database: customer unit

Data Attribute Name: WINCH Format: X(3)
Full Name: Winch Required
Description: Denotes if a winch is required as part of the configuration of a vehicle role code.
Domain: None specified
Purpose: Allows selection of vehicle roles suitable for tasks that require a winch.
Entity: VEH_ROLE
Source of data requirement: DI(AF)AAP3631.001 Chapter 15
Source of raw data for database: DI(AF)AAP3631.001 Chapter 15

Appendix C: Entity Attribute List

Introduction

The entity attribute (EA) list is used to in conjunction with the data dictionary and entity relationship (ER) diagram to represent a model of the database. It was developed and maintained on Ashton Tate's dBase III Plus™ and the report produced with Relational Report Writer™.

The term "Entity" refers to the grouping of two or more data attributes or fields. Attributes are listed in alphabetical sequence except for primary and secondary keys, which appear first. A primary key is the unique identifier of a record in that entity. Where more than one attribute is listed as the primary key, these are joined or concatenated together to form the primary key. Primary keys are represented in the database as indexes to the entities. A secondary key is the primary key in another entity. Its inclusion as a secondary key in an entity relates it to a specific occurrence (or record) of the other entity.

Entity Attribute List in Entity Sequence

Entity: CUSTEL -- Customer Element

Attributes:

Short name	Status	Format	Long name
CUSTEL_ID	Primary	X(15)	Customer Element Identifier
CUSTU_SNAM	Foreign key to CUSTUNIT	X(15)	Customer Unit Short Name
CUSTEL_NAM	Attribute	X(30)	Customer Element Name
CUSTEL_PH	Attribute	9(5)	Customer Element Phone Extension

Entity: CUSTUNIT -- Customer Unit

Attributes:

Short name	Status	Format	Long name
CUSTU_SNAM	Primary	X(5)	Customer Unit Short Name
CUSTADDRES	Attribute	X(50)	Customer Address
CUSTROLE	Attribute	X(30)	Customer Unit Role
CUSTU_TITL	Attribute	X(30)	Customer Unit Full Title
CUST_ID	Attribute	X(5)	Customer Unit Designator Code
FAL	Attribute	9(1)	Force Activity Designator

Entity: DEPLOY -- Deployment

Attributes:

Short name	Status	Format	Long name
SELFDEP	Primary	X(2)	Self Deployment Code
SELFDEP_D	Attribute	X(145)	Self Deployment Code Description

Entity: ESTAUTH -- Establishment Authority

Attributes:

Short name	Status	Format	Long name
EST_LINE	Primary	9(3)	Establishment Line
EST_TYPE	Primary	X(2)	Establishment Type
E_FILE_REF	Primary	X(4)	Establishment Table File Reference
ROLE_CODE	Primary	X(3)	Surface Vehicle Role Code
CUSTEL_ID	Foreign key to CUSTEL	X(13)	Customer Element Identifier
ROLE_CODE	Foreign key to VEH_ROLE	X(3)	Surface Vehicle Role Code

V_FILE_REF	Foreign key to EVR	X(4)	EVR File Reference
DATE_L_AMD	Attribute	dd/mm/yy	Date Establishment Line Last Amended
ESTAUTHRMK	Attribute	X(30)	Establishment Authority Remarks
EST_DATE	Attribute	dd/mm/yy	Establishment Date
LASTREVIEW	Attribute	dd/mm/yy	Last Review Date
L_WEF_DATE	Attribute	dd/mm/yy	Establishment Authority Line With Effect Date
QTYEST	Attribute	9(3)	Establishment - Quantity

Entity: EST_TYPE -- Establishment Type

Attributes:

Short name	Status	Format	Long name
EST_TYPE	Primary	X(2)	Establishment Type
EST_TYPE_D	Attribute	X(20)	Establishment Type Description.

Entity: EVR -- Establishment Variation Request

Attributes:

Short name	Status	Format	Long name
V_FILE_REF	Primary	X(40)	EVR File Reference
CUSTU_SNAM	Foreign key to CUSTUNIT	X(15)	Customer Unit Short Name
E_FILE_REF	Foreign key to E_TABLE	X(4)	Establishment Table File Reference
E_UNIT_ID	Foreign key to E_UNIT	X(5)	Establishment Unit Identifier
CMD_REF	Attribute	X(40)	Command File Reference
EU_FILEREF	Attribute	X(40)	Establishment Unit File Reference
EVR_DATE	Attribute	dd/mm/yy	Date EVR Submitted

EVR_RMKS	Attribute	X(200)	Establishment Variation Request Remarks

Entity: EVR_OFF -- Establishment Variation Request Offset

Attributes:

Short name	Status	Format	Long name
CUSTEL_ID	Primary	X(15)	Customer Element Identifier
EST_LINE	Primary	9(3)	Establishment Line Identifier
EST_TYPE	Primary	X(2)	Establishment Type
E_FILE_REF	Primary	X(4)	Establishment Table File Reference
ROLE_CODE	Primary	X(3)	Surface Vehicle Role Code
V_FILE_REF	Primary	X(40)	EVR File Reference
CUSTEL_ID	Foreign key to CUSTEL	X(15)	Customer Unit Element Identifier
EVR_OFFRMK	Attribute	X(50)	EVR Offset Remarks
QTY_OFFSET	Attribute	s9(3)	Role Code Quantity Offset

Entity: EVR_VAR -- Establishment Variation Request Variation

Attributes:

Short name	Status	Format	Long name
CUSTEL_ID	Primary	X(15)	Customer Unit Element Identifier
ROLE_CODE	Primary	X(3)	Surface Vehicle Role Code
V_FILE_REF	Primary	X(40)	EVR File Reference
EVR_TASK	Attribute	X(100)	Nature of Tasking for EVR Variation
EVR_VARQTY	Attribute	S9(3)	EVR Variation Quantity
V_WEF_DATE	Attribute	dd/mm/yy	EVR With Effect Date

Entity: E_TABLE -- Establishment Table

Attributes:

Short name	Status	Format	Long name

E_FILE_REF	Primary	X(4)	Establishment Table File Reference
E_UNIT_ID	Foreign key to E_UNIT	X(5)	Establishment Unit Identifier
DATE_E_AMD	Attribute	dd/mm/yy	Date Establishment Table Last Amended
DATE_E_CRE	Attribute	dd/mm/yy	Date Establishment Table Created
EU_NAME	Attribute	X(10)	Establishment Unit Name
E_AMEND_NO	Attribute	9(3)	Establishment Table Amendment Number
E_WEF_DATE	Attribute	dd/mm/yy	Establishment Table With Effect Date
UTIL_PRAM	Attribute	9.9	Establishment Utilisation Parameter

Entity: E_UNIT -- Establishment Unit

Attributes:

Short name	Status	Format	Long name
EUNAME	Primary	X(10)	Establishment Unit Name
E_UNIT_ID	Primary	X(5)	Establishment Unit Identifier
EU_ADDRESS	Attribute	X(50)	Establishment Unit Address
E_UNIT_EXT	Attribute	9(5)	Establishment Unit Telephone Contact Extension

Entity: MOBILITY -- Mobility

Attributes:

Short name	Status	Format	Long name
MOBCAT	Primary	9(1)	Mobility Category
MOBCAT_DES	Attribute	X(150)	Mobility Category Description

Entity: R_ANNOT -- Role Annotation

Attributes:

Short name	Status	Format	Long name
R_ANNOTATE	Primary	X(1)	Role Annotation
R_ANNOT_D	Attribute	X(120)	Role Annotation Description

Entity: SV_CAT -- Surface Vehicle Category

Attributes:

Short name	Status	Format	Long name
SV_CAT	Primary	X(2)	Surface Vehicle Category
SV_CAT_DES	Attribute	X(45)	Surface Vehicle Category Description

Entity: VEH_ROLE -- Vehicle Role

Attributes:

Short name	Status	Format	Long name
ROLE_CODE	Primary	X(3)	Surface Vehicle Role Code
MOBCAT	Foreign key to MOBILITY	9(1)	Mobility Category
R_ANNOTATE	Foreign key to R_ANNOT	X(1)	Role Annotation
SELFDEP	Foreign key to DEPLOY	X(2)	Self Deployment Code
SV_CAT	Foreign key to SV_CAT	X(2)	Surface Vehicle Category
AIRPORTABI	Attribute	X(3)	Airportability
CAMOUFLAGE	Attribute	X(3)	Approval for Camouflage
D_PRICE_ER	Attribute	dd/mm/yy	Date Estimated Replacement Price Updated
ILM_VENUE	Attribute	X(4)	Intermediate Level Maintenance Venue
LIC_CODE	Attribute	X(2)	Licence Code

LOTKM	Attribute	9(6)	Life of Type Kilometers
LOTYEARS	Attribute	9(2)	Life of Type - Years
MAX_CARGO	Attribute	9(5)	Maximum Cargo
MAX_LITRES	Attribute	9(9)	Maximum Litres Bulk Liquid Cargo
MAX_PAX	Attribute	9(2)	Maximum Passengers
NSN	Attribute	9(13)	NATO Stock Number
PRICE_ER	Attribute	9(6)	Estimated Replacement Price
RADIO	Attribute	X(3)	Radio Required
ROLE_DESC	Attribute	X(50)	Surface Vehicle Role Code Description
STDISN_REQ	Attribute	X(3)	Standardisation Required
STD_COLOUR	Attribute	X(10)	Standard Colour
SUP_SOURCE	Attribute	X(6)	Vehicle Supply Source Category
SYS_ENG	Attribute	X(4)	Systems Engineer
V_OP_CLASS	Attribute	X(4)	Vehicle Operational Classification
WINCH	Attribute	X(3)	Winch Required

Appendix D: ESTAB User Manual

Royal Australian Air Force

Motor Transport Establishment Management Information System (ESTAB) User Manual

PREPARED BY

FLIGHT LIEUTENANT ROBERT T. QUIRK, RAAF
Graduate Student
Air Force Institute of Technology
School of Systems and Logistics
20 July 1990

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ESTAB User Manual

Introduction

The Establishment DBMS application (ESTAB) automates aspects of the DMOVT-AF Motor Transport (MT) establishment management functions. The DBMS uses Nantucket Corporation's Clipper™ computer language in conjunction with Aston-Tate dBASE III Plus™ compatible databases and indexes. The system allows users with a working knowledge of the RAAF MT establishment system and data entry processes to add, edit, delete, and report database information. The application requires little knowledge of the packages used to create the system, however a basic knowledge of database concepts would assist the user in understanding and using the system.

The ESTAB User's Manual provides a reference for DBMS operations. You should read this short manual in its entirety before attempting to either install or perform tasks with ESTAB.

Computer Hardware Requirements. ESTAB was designed to run on IBM and IBM compatible microcomputers to be purchased in accordance with DESINE standards. The application is too large to be run from a 5.25 inch drive and must be installed on the hard disk of the microcomputer. Additionally, you will require 640 k of random access memory (RAM).

Computer Configuration Requirements. The application requires the "config.sys" file to contain the following statements:

```
buffers = 20
files  = 20
```

The existence of too many terminate and stay resistent (TSR) programs will reduce the availability of RAM to ESTAB. If ESTAB states "Not enough memory" you will need to disable some or all of the TSRs to execute the program. This should not normally pose a problem.

Installation

The following information is provided to supplement the on-screen instructions provided during the installation of ESTAB.

An installation program allows you to easily install a working copy of ESTAB to your hard disk. You should have one 5.25 inch disk: ESTAB 1 available for this task. To load ESTAB you require a hard disk with 2 megabytes of free memory on the "C" drive.

Installation when DTREE is Active. "DTREE" is a directory program that has been installed on your micro-computer. DTREE must be deactivated or bypassed to load ESTAB. If DTREE is active, select "QUIT" in DTREE to return you to the DOS "C:>" prompt.

Previous Versions of ESTAB. If you are running a previous copy of ESTAB in the ESTAB.DEM directory on your C drive, you will need to run RID.BAT contained on disk 1 to erase it. If you have files in that directory that you wish not to delete, you must remove them to another directory before running RID.

To run RID, insert disk 1 in the A drive and type "a:". After the "A:>" appears type "RID" and press <Enter>. All the files in that directory will be erased and the directory will be removed from the disk.

Installing ESTAB. To install ESTAB, type "INSTALL" at the "A:>" prompt and press <Enter>. The install program will copy across all the

program, database, and index files from disk 1 that make up ESTAB. You are now ready to run ESTAB.

Getting Started

The installation program will leave you in the "C:\ESTAB.DEM" directory. If you wish to start ESTAB from outside this directory, you should include that directory in your AUTOEXEC.BAT path statement. For more information on path statements consult your DOS manual.

DTREE Bypass. ESTAB can be run from either within DTREE or straight from the DOS prompt. To bypass DTREE, select QUIT in DTREE and you will be returned to the "C:>" prompt. Type "CD C:\ESTAB.DEM" and press <Enter>. You will now see the "C:\ESTAB.DEM>" prompt telling you that you are now in the ESTAB.DEM directory on the C drive.
To start ESTAB type "ESTAB" at the "C:\ESTAB.DEM" prompt. The first thing you will see is a long horizontal box. Figure UM-1 is the main menu.

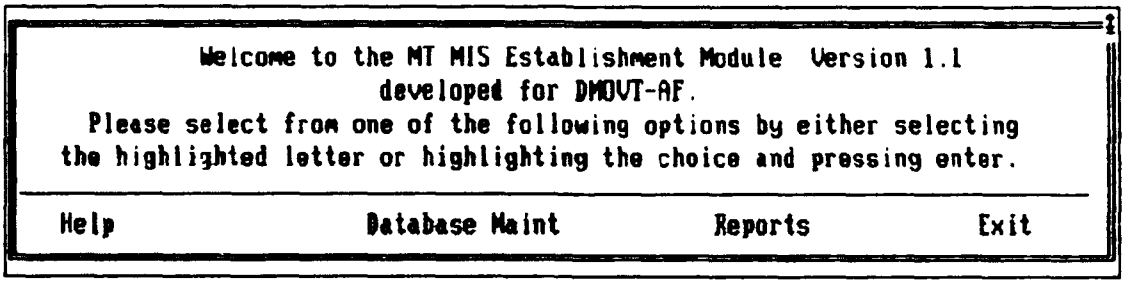

Figure UM-1. Main menu

Main Menu. The main menu provides four possible selections: Help, Database Maintenance, Reports, and Exit. The Help selection will provide basic information about it and the other three main menu

selections. Directions to assist you are provided on each of the menus and the functions.

Pull-down Menus. Pull-down menus, such as depicted in Figure UM-2, have been installed to allow you perform functions and to trace your path back to higher levels.

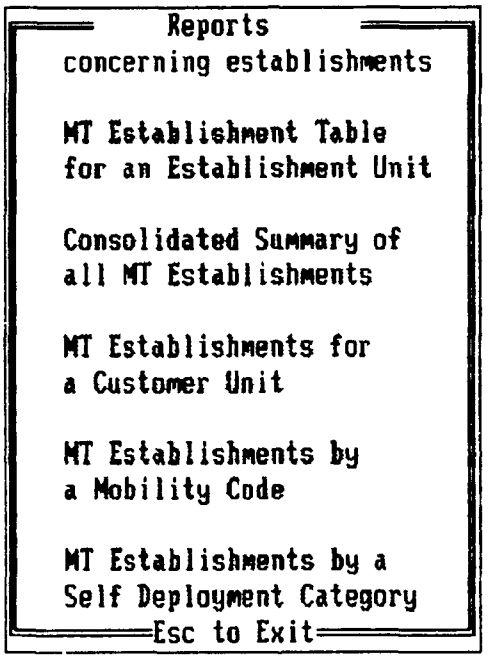

Figure UM-2. Pull-down Menus

There are two ways to activate a selection:

a. highlight the option by using the cursor or arrow keys on the keyboard, or

b. press the highlighted letter of the selection that you require.

The Help Selection. A brief explanation of functions is provided to the user for each section. The Help selection from the main menu provides a brief summary of the functions of each section. Comments are

provided on each menu to assist you. Menus in Delete and Report functions provide explanations at the bottom left corner of the screen. These explanations change with each option highlighted. For more information about each function of ESTAB refer to the later sections of this manual.

Quitting an Operation. At any stage you want to abort what you are doing in ESTAB just hit the escape key (<Esc>) and follow the directions. You may need to do this a number of times to quit lower menus and procedures.

Database Maintenance

There are three possible selections from this the Database Maintenance Menu (Figure UM-3).

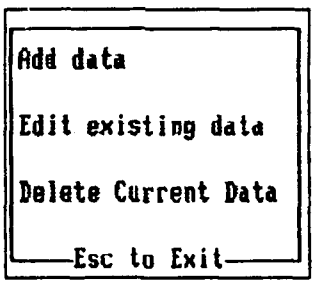

Figure UM-3. Database Maintenance Menu

ADD allows you to add additional data to the database that you select in the next menu. EDIT allows you to make any necessary changes to information contained in the database that you choose on the next menu. Delete allows you to delete a record from the database that you choose from the next menu (Figure UM-4).

Adding Data. ESTAB allows you to enter a great deal of information about vehicles (role codes), establishments, and customers. See Figure UM-4 for these areas.

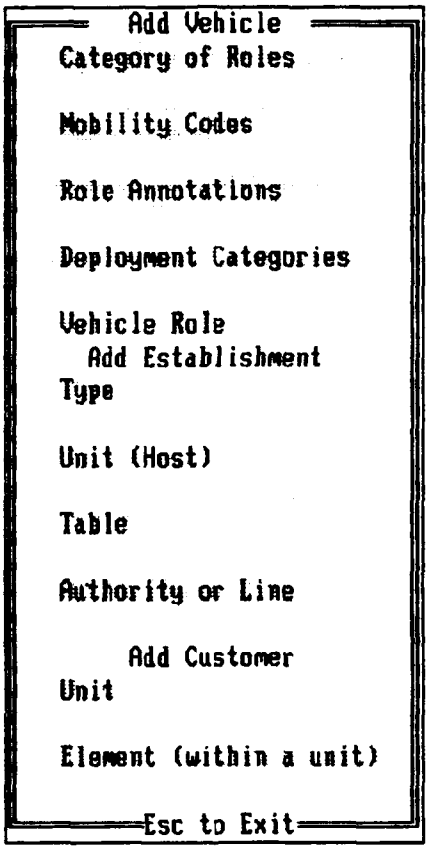

Figure UM-4. Add Menu

The programs check the information as you enter it. If you attempt to enter a value to a field ESTAB doesn't know from its tables, it will ask you if you wish to use the lookup table. If you can't find the value that you wanted, you must either:

a) enter another value and edit it later with the edit option or,

b) exit and add the new value to the appropriate database.

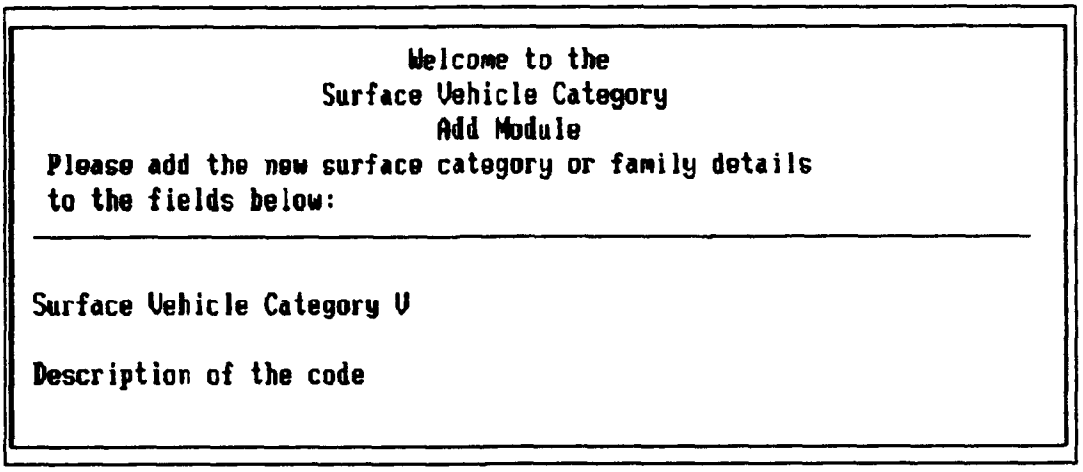

Figure UM-5. Add Screen

Both ADD and EDIT options will allow you to change any of the values in the highlighted fields on the screen (Figure UM-5). When you are satisfied press the control and W keys simultaneously (<Ctrl W>) or if you wish to exit press the escape key (<Esc>). You may be again asked to choose between these actions depending upon when you decided to stop adding or editing the record. If you proceeded to the last highlighted field before making the selection, you will only be asked once.

Some fields are too long to fit on the screen all at once. For these (Mobility, Self Deployment, and Role Annotation descriptions), the field will scroll left and right. To get to the first letter when in this field, press "HOME". To reach the last letter, press "END".

Locating and Editing Data. ESTAB allows you to identify the record you want to edit with a lookup window (Figure UM-6). This lookup window is also used in delete and some report functions.

As with the ADD procedures, ESTAB will check your input in important fields. If your value doesn't exist you will be queried to

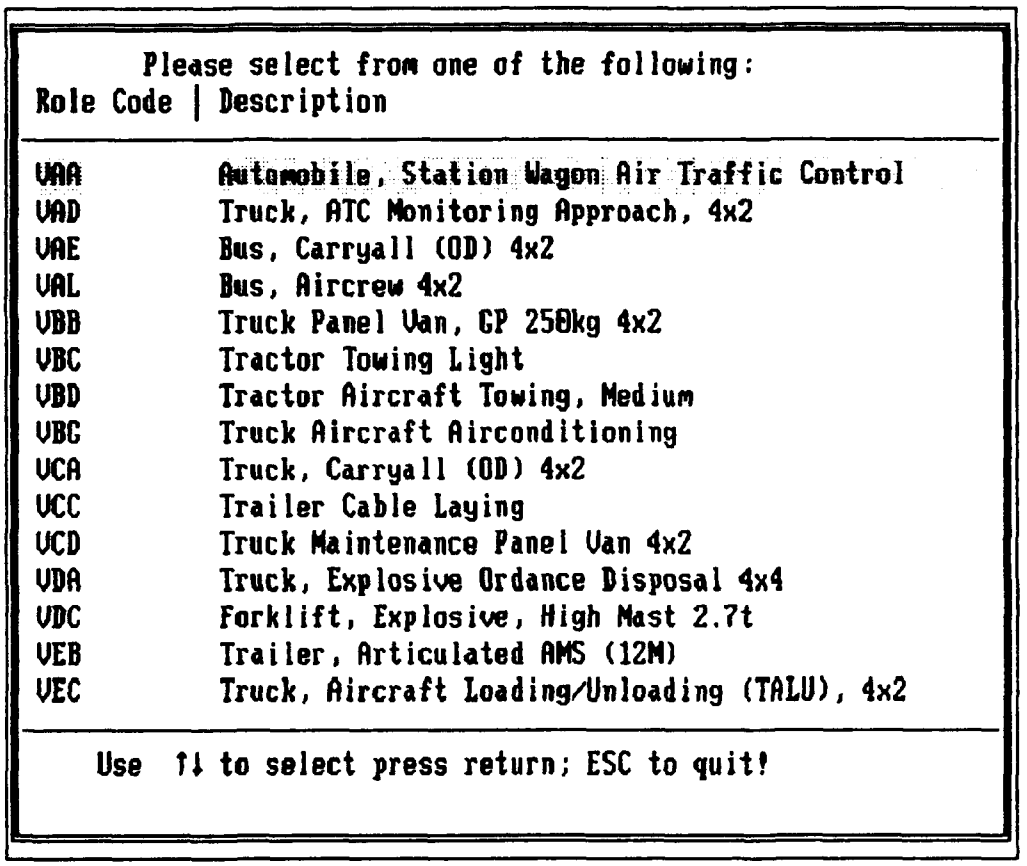

Figure UM-6. Lookup Window

pick a current value or have another attempt at entering the value. To save, press <Ctrl W>and to escape, press <Esc>.

Deleting Data. ESTAB allows you to lookup which record from the entity you wish to delete. This table will appear after the following screen similar to Figure UM-7. If at any stage you wish to quit press <Esc>. The record will not be deleted.

As stated in the introduction, ESTAB has been organised to ensure the accuracy and validity of all data input to the fields. Data is checked on input and editing to ensure that it appears in related records in other tables.

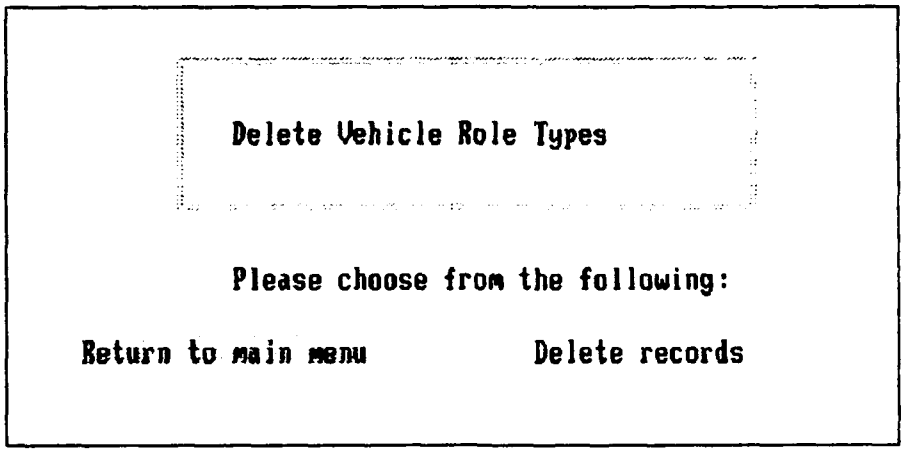

Figure UM-7. Delete Screen

A word of warning about deleting. Deleting occurrences of lower level records such as a "Vehicle Role Code" will effect linked information. You should delete occurrences of records containing that information in related tables before removing the source of that information. For example, if you were going to remove Role Code "VAA", you should remove all reference to "VAA" in establishment authorities beforehand so that they do not become orphans values.

Reports. ESTAB allows you to produce reports to three possible destinations: printer, display (monitor), or file as shown in Figure UM-8.

ESTAB will check to see if the printer is ready before attempting to write your report. All reports are currently designed for an EPSON compatible printer. If you elect to dump the report to a file, it will be saved in ASCII text. Please ensure that the filename used is legal in DOS (i.e. 8 letters with a 3 letter extension. e.g. REPORT.TXT) otherwise an error will occur. You may also include a path (e.g. A:REPORT.TXT) to direct your report to another disk or directory.

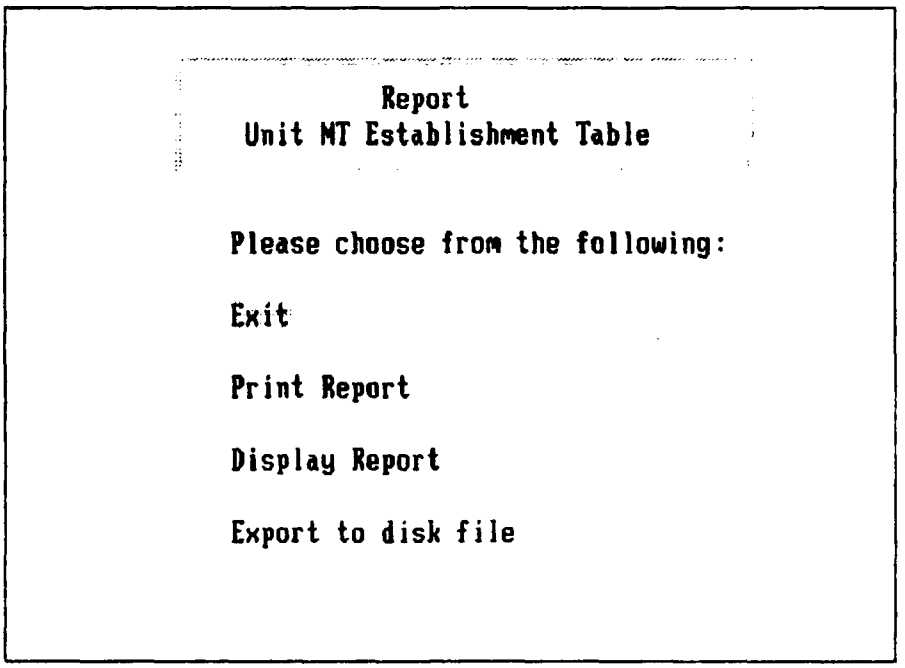

Figure UM-8. Typical Report Menu

Some specific reports also use lookups to identify the information you require. This will save you having to print out all the database information in the report. A brief description of the reports follows.

Establishment Reports

These reports deal with information about the MT establishment. They allow the MT establishment to be viewed from a number of different perspectives. Figure UM-9 is the Establishment Reports Menu.

MT Establishment Table for an Establishment Unit. This report will produce a listing of all current authorised MT Establishments for a particular unit responsible for holding and managing an establishment. The particular unit required must be selected from a pick-list displayed following the report menu.

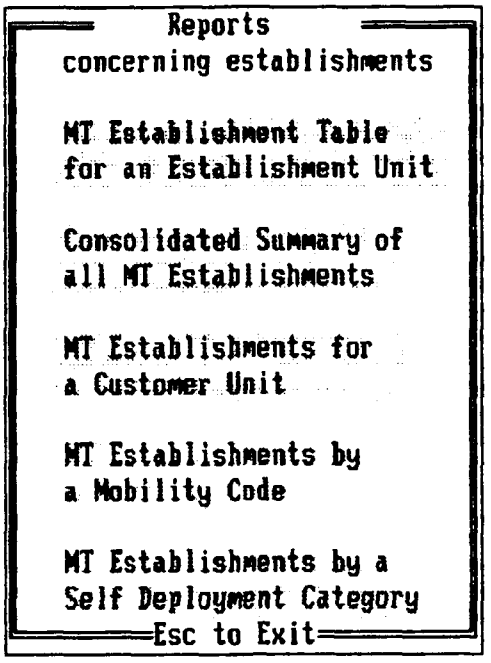

Figure UM-9. Establishment Reports Menu

Consolidated Summary of all MT Establishments. A consolidated list of all vehicle holdings by establishment table, establishment type,and vehicle role can be provided by this option. This could be a lengthy report and would be best run during standdown periods or other times when the computer is not required.

MT Establishments for a Customer Unit. This report will list all MT authorisations for a customer unit across all establishment tables.

MT Establishments by Mobility Code. This report allows listing of all current MT establishments to be selected from a pick-list. The report allows checking the validity of all establishments from a mobility perspective.

MT Establishments by Self Deployment Category. This report allows listing of all MT establishments for all vehicle role codes that have a given Self Deployment Category. The Self Deployment Category must be

selected from a displayed pick-list. The report allows checking the validity of all establishments from a deployment perspective.

Policy Reports

These reports deal with policy decided by DMOVT-AF that directly affects MT establishments. Figure UM-10 is the Policy Reports Menu.

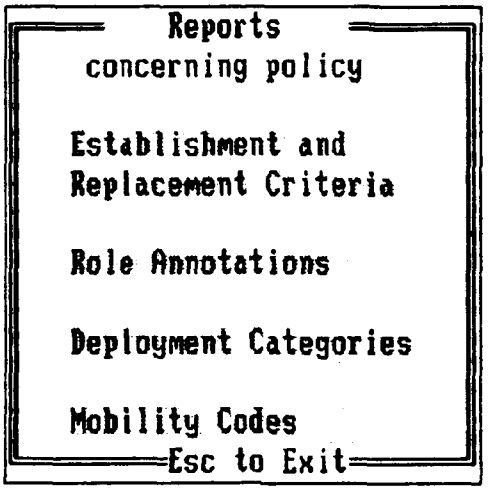

Figure UM-10. Policy Reports Menu

Establishment and Replacement Criteria. This report produces a list of all vehicle role codes and their associated establishment and replacement criteria. The format of this report is the same as the report of the same name that appears in Chapter 15 of DI(AF)AAP3635.001.

Role Annotations. This report lists all annotations that restrict the employment of vehicles against MT establishments. The report is formatted as Annex A to the Establishment and Replacement Criteria Report described above.

Deployment Categories. The Deployment Categories Report lists all current Self Deployment Categories in the format of Annex B to the Establishment and Replacement Criteria Report.

Mobility Codes. The Mobility Codes Report lists all current mobility codes and their abbreviations in a format of Annex C to the Establishment and Replacement Criteria Report.

Vehicle Role Code Reports

These three reports provide listings of the current vehicle roles by different perspectives. These reports allow checking of controlled codes allocated against all vehicle types. Figure UM-11 illustrates the Vehicle Report Menu.

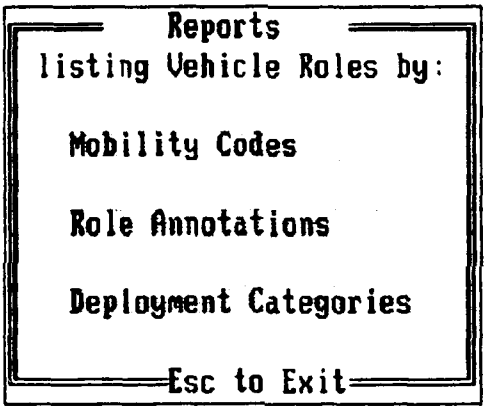

Figure UM-11. Vehicles Report Menu

Mobility Codes. This report lists all vehicle types in ascending role code sequence grouped by each mobility classification.

Role Annotations. This report lists all vehicle types is ascending role code sequence grouped by each role annotation classification.

Deployment Categories. This report lists all vehicle types in ascending role code sequence grouped by their ability to self deploy to remote locations.

Tutorials

The following represent some notes of guidance for the inexperienced user of ESTAB. The tutorials are aimed at familiarising the user with the generic functions of ESTAB.

Creating an Establishment Table

Before creating a new Establishment Table, information that table will refer to must be loaded. If the Establishment Unit responsible for managing the establishment does not exist, it must be added first. Should you attempt to add an Establishment Table when these details do not exist you will need to exit and add them before resuming the creation of the table. The following paragraphs provide a step-by-step approach to creating a new table, including adding Establishment Unit details.

Adding an Establishment Unit. To add an Establishment Unit from the main menu, press "DAH". The following screen will appear (Figure UM-12). Fill in all the fields. When you are satisfied with your entries and wish to save, press <Ctrl W>. If you wish to abort the add, press <Esc>.

Adding an Establishment Table. To add a new Establishment Table, return to the Add menu and press <b>. You will see the following screen (Figure UM-13).

The following notes may assist you. Establishment Table reference is a code four letters long that usually begins with "VE". You must enter a value in this field.

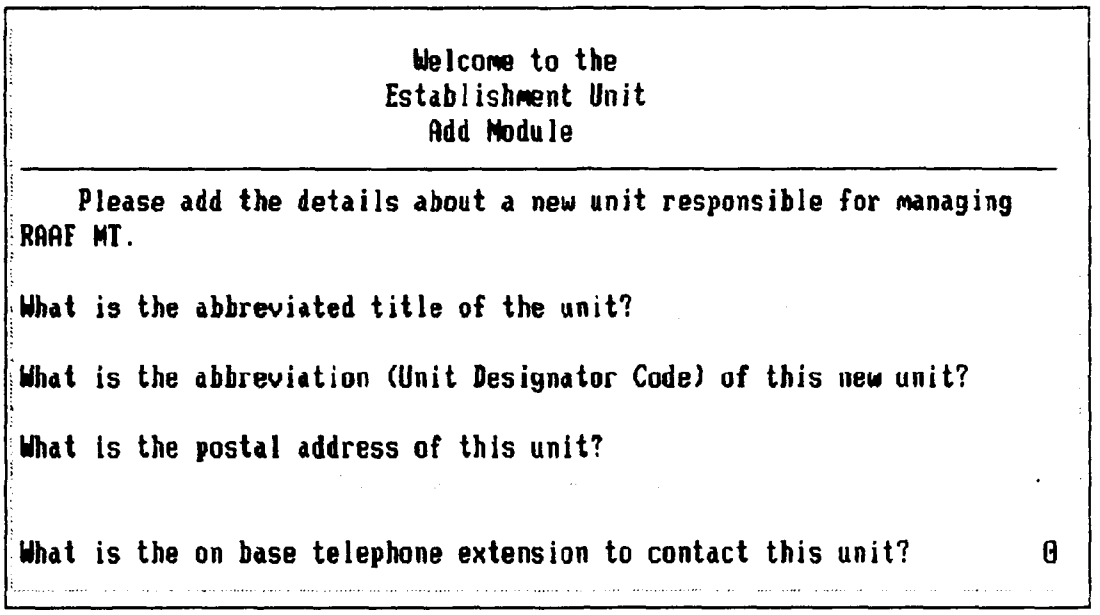

Figure UM-12. Add Establishment Unit Screen

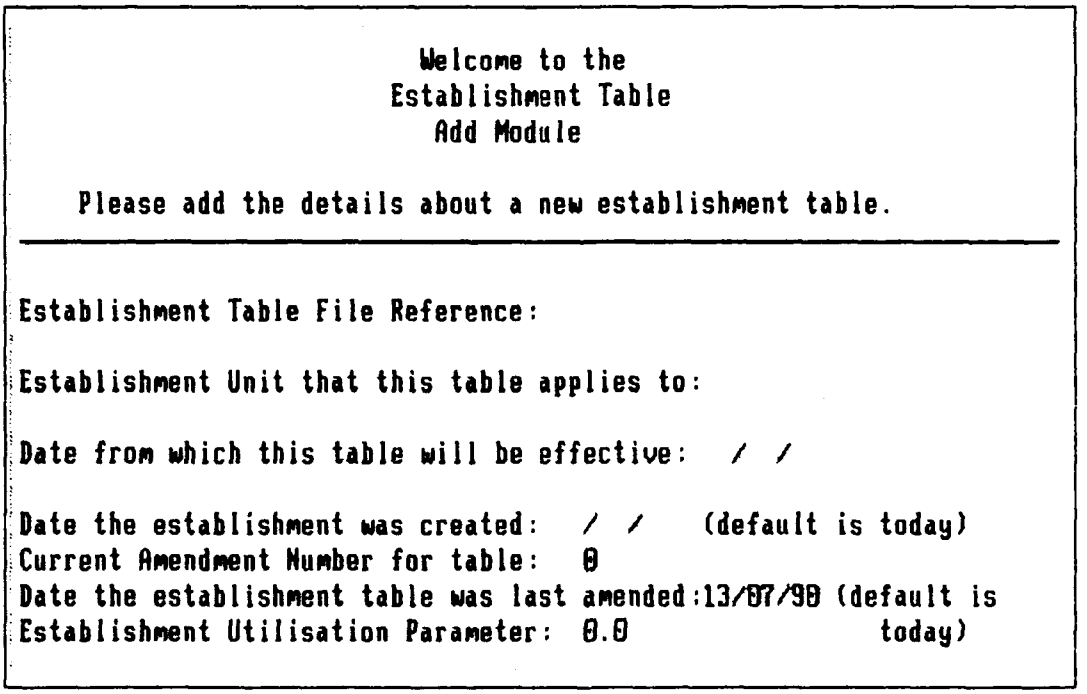

Figure UM-13. Add Establishment Table Screen

The Establishment Unit is the unit responsible for managing theestablishment. This would normally be a Supply Support Squadron or Base Squadron that has an RMS.

All dates are in day/month/year format. The with-effect date, creation, and amendment dates for the table are set at today's date when you are adding a new table. You may amend these to other valid dates if you wish.

The current amendment number is set to 0 when the table is created.

The establishment utilization parameter is set to 0.8. This may be adjusted to reflect different management emphasis on utilization rates for vehicle authorisations allocated to this table.

When you have completed all the entries and are satisfied with your input, press <Ctrl W>. If you wish to abort the add, press <Esc>.

Creating an Establishment Authority

To create an establishment authority or line on an Establishment Table, you require information about who will be responsible for the vehicle. This was normally shown as an annotation to the old Establishment Tables. If this Customer Element and its parent unit have not been loaded into the Customer Element and Customer Unit database you will need to complete that first. Load the Customer Unit and then the Customer Element the same way as described for Establishment Tables. You are now ready to proceed with adding an authority.

Adding an Authority. Once you select "A" in the Add menu you will see the following screen (Figure UM-14). "UE" for "Unit Establishment" has been set as a default. You may change that to any other valid

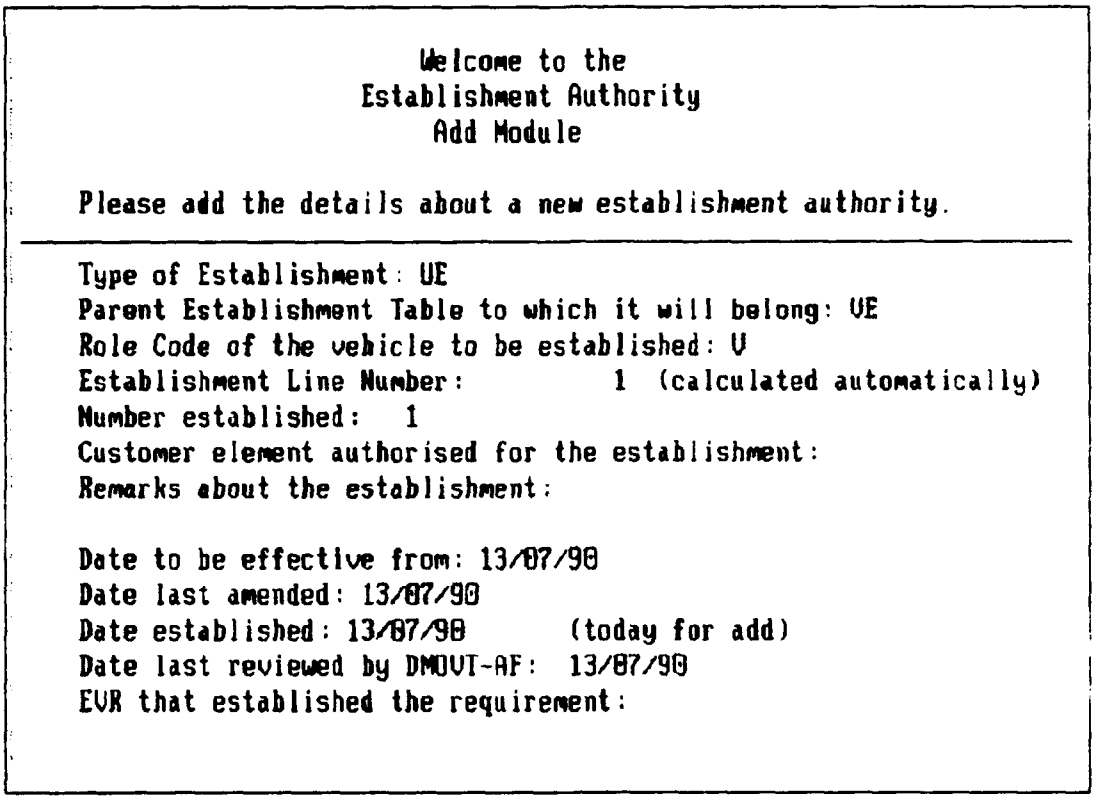

Figure UM-14. Add Establishment Authority Screen

option. If you provide other than a valid type of establishment, you will receive a warning and may select from a pick-list to make you entry.

The parent establishment table must exist prior to completing the next step. You will be asked to input its value. If you can't recall, press <Enter>. You will receive a warning and may select from the pick-list of correct values.

The role code can be selected from a pick-list in a similar manner to the above if you can't recall the details or wish to check them.

ESTAB automatically calculates a unique Establishment Line Number for that vehicle role on that Establishment Table.

"Number Established:" allows you to designate the number of vehicles established for use by the customer element stated on the next line.

You are allowed to make remarks of up to 30 characters that will be stored with the authority.

All date fields are set to a default of today's date during the addition of authorities. Adjust these dates if necessary.

The facility exists for four letter reference to the Establishment Vehicle Request that led to the establishment of the authority.

Removing an Establishment Authority

Removing an establishment authority is easy. Simply choose the Database Maintenance "Delete Current Data" option. Select "Authority or line" and you will be presented with the following screen (Figure UM-15).

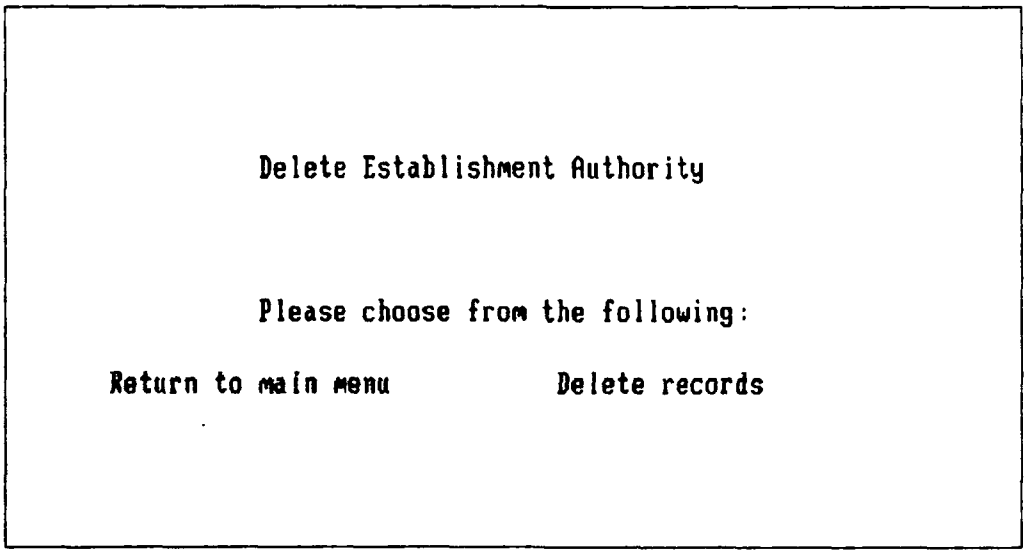

Figure UM-15. Delete Establishment Authority Screen

To delete records select "Delete Records". You will be presented with a pick-list. Choose the record using the cursor (arrow) keys and press <Enter> to select. A short cut to finding the record is to press the first letter of the establishment type. The screen will scroll to place the first record of that type at the top of the list. This may save some keystrokes and time.

Once you have selected a record, you will be asked to confirm. If you wish to forget this selection, select "NO". If you wish to carry out the deletion, select "YES". You will be returned to the delete menu. To delete another record follow the above steps. To exit, either press <Esc> or select, "Return to Main Menu".

Editing an Authority or Table

All editing procedures in ESTAB are similar. Using a pick-list you can choose the record to edit. Once you have selected the record, you will be presented with a screen showing the current values of the fields in that record (Figure UM-16).

The screen will be similar to an add screen except you will not be allowed to edit the information (primary keys) used to identify the record. Once you have made the necessary amendments, use the same procedure as with the other add routines to save your work, <Ctrl W> to save or, <Esc> to exit.

This tutorial was aimed at providing you with additional guidance to familiarise you with the features of ESTAB. ESTAB has been designed so that all like procedures operate in a similar manner. Mastering the above procedures will put you well on the way to mastering the use of ESTAB. Good luck!

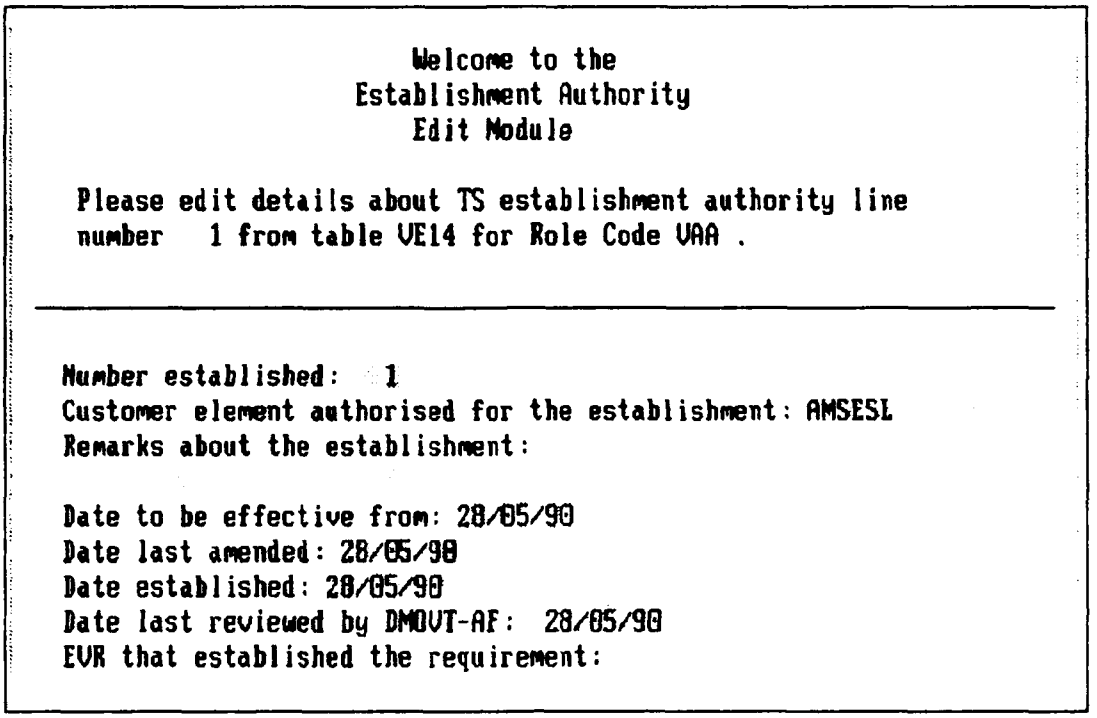

Figure UM-16. Editing an Establishment Authority Screen

Appendix E: MT MIS Entity Relationship Diagrams

Figures E-1 and E-2 depict entities required in an integrated MT MIS. For reproduction purposes the figures were separated into the those entities required by an RMS and those required by SG3. The RMS information requirements center around daily operational transactions while SG3 interests are in higher level aggregated data.

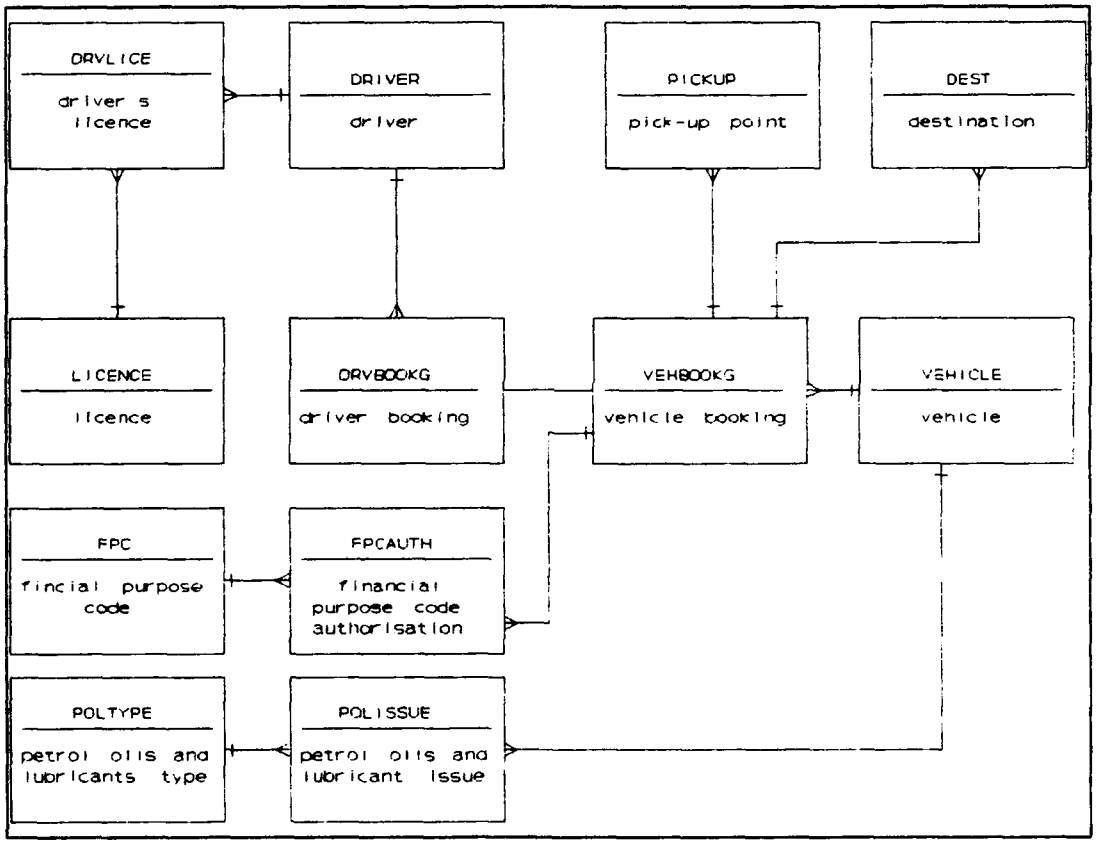

Figure E-1. Road Movements Section Aspects of an MT MIS

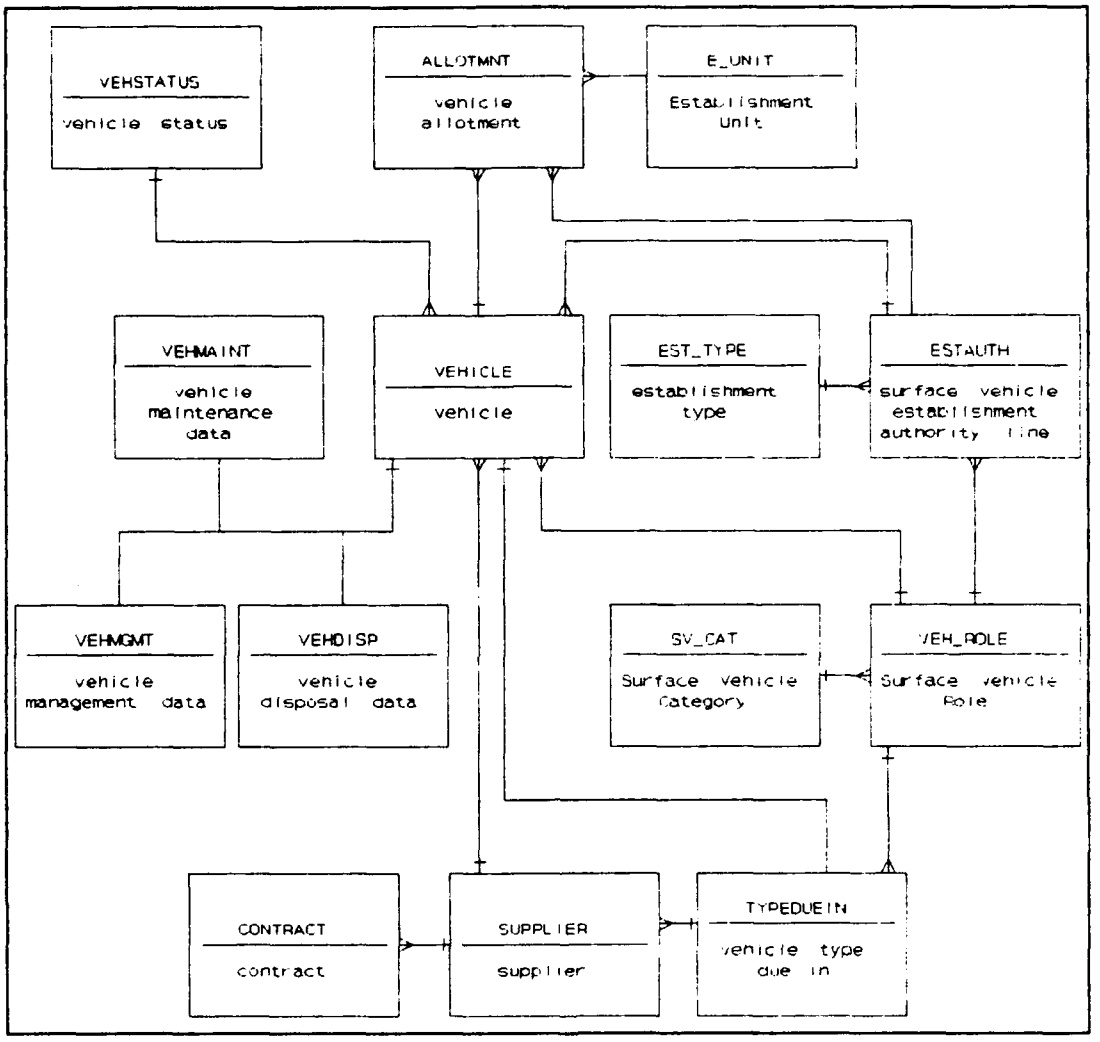

Figure E-2. Support Group 3 Aspects of an MT MIS

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Vita

Flight Lieutenant Robert T. Quirk [redacted] In 1978, he graduated from Saint Laurences College, South Brisbane and joined the Royal Australian Air Force (RAAF) as an officer cadet to study at the Darling Downs Institute of Advanced Education, Toowoomba. He graduated with a degree of Bachelor of Business Studies in Computing in 1981. Upon graduation, he was commissioned as a Supply Officer in the RAAF and posted to RAAF Pearce, Western Australia. There he served as Stores Accounting Officer, Air Movements Officer, and Movements Officer. Through 1985 and 1986, Flight Lieutenant Quirk was posted to the Supply Systems Redevelopment Project to perform systems analyst duties. In 1987, he was posted to Movements Office, RAAF Amberley where he served until entering the School of Systems and Logistics, Air Force Institute of Technology in May 1989.

[redacted]

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1990	Masters Thesis

4. TITLE AND SUBTITLE
Automating Establishment Management for the RAAF Motor Transport Fleet: A Microcomputer Database Application

5. FUNDING NUMBERS

6. AUTHOR(S)
Robert T. Quirk, Flight Lieutenant, RAAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology,
WPAFB OH 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/LSM/90S-44

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

thesis

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The purpose of this study was to research the requirements for, and develop, a microcomputer based database application to automate establishment management of the Royal Australian Air Force (RAAF) motor transport (MT) fleet at the Directorate of Movement and Transport Air Force (DMOVT-AF). This application was assessed as the priority module for development by DMOVT-AF as part of a larger management information system (MIS) for RAAF MT assets.

This research selected systems analysis tools and the most appropriate software, determined user requirements, developed, evaluated, and validated a prototype system. The resulting software application, the Motor Transport Establishment Management Information System (ESTAB), met user requirements, improved efficiency, and accuracy at DMOVT-AF. It was designed to operate on IBM compatible personal computers in accordance with Australian Department of Defence DESINE standards. ESTAB integrates data from various sources and provides the ability to add, edit and report motor transport establishment information.

Keywords

14. SUBJECT TERMS
Data Base, Data Management, Information Systems, Management Information Systems, Microcomputers, Transportation, Computer Programing (KR)

15. NUMBER OF PAGES
145

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL